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## ORIGINAL MEMOIRS.

# BENIGN BONE CYSTS, OSTITIS FIBROSA, GIANT-CELL SARCOMA AND BONE ANEURISM OF THE LONG PIPE BONES.*

A CLINICAL AND PATHOLOGICAL STUDY WITH THE CONCLUSION THAT CONSERVATIVE TREATMENT IS JUSTIFIABLE.

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IN many surgical lesions technic is ahead of diagnosis.

The development of technic is more rapid, because the results of faulty technic are immediate, while the development of diagnosis is more difficult, especially in tumors, because the results are more remote.

Treatment of tumors which will insure the patient the greatest possibility of a permanent cure with the least mutilation will only be accomplished when surgeons have a better conception of the local growth of neoplasms, both benign and malignant, and are able to diagnose with differentiation the various lesions at the exploratory incision, with, or better without, the aid of a rapidly frozen section.

This is especially true of bone lesions, and I propose to discuss here the three mentioned in the title of this paper.

* Read before the American Surgical Association, May 3, 1910.

BENIGN BONE CYSTS AND OSTITIS FIBROSA.

In the literature (and including my own collection) up to April, 1910, I have studied 89 cases which are classified as bone cysts. These may be divided into two large groups: (A) the true bone cysts, which have a definite relation to ostitis fibrosa, and (B) cysts in the medullary cavity due to other conditions.

Of the first group (A) there are 69 cases, and they may be divided in the following six varieties:

1. Medullary cysts (16 cases), in which the bony shell has no definite connective-tissue lining (Figs. 1 and 2). Here, in the gross, there is nothing but the fluid contents and the bone shell, but microscopically one is always able to find between the bone lamellæ of the bone shell a new connective tissue—microscopically ostitis fibrosa. Two of the cases upon which I operated belong to this type, and I am quite positive as to the practical absence of a definite connective-tissue lining.

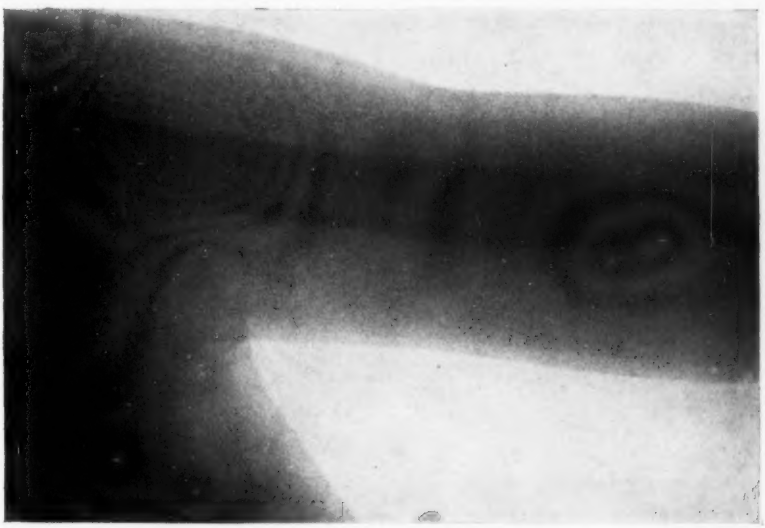
2. In this variety (22 cases) there is a definite connective-tissue lining which can be peeled from the bony shell (Fig. 3). Microscopically, it is identical with the fibrous tissue between the bone lamellæ in the bone shell of the first variety. Two cases, sent to me by Dr. Eisendrath of Chicago, and one, sent to my laboratory by my colleague, Dr. Baer, belong here. So that I am quite convinced of the presence of this definite connective-tissue lining which I have seen in the gross and examined microscopically. The case operated on by Dr. Sowers of Washington (Fig. 4) (the tissue of which he brought to me for examination) is an example of one in which the connective-tissue lining was thickest—5 to 8 mm. It is usually 1 to 2 mm.

3. In this smaller group of cases (6 cases) the cyst in the medullary cavity is a small affair. It may be single or multiple, usually the former. The medullary cavity is filled with the same fibrous tissue which formed the connective-tissue membrane of the second group. I have had the opportunity to see an example in the tissue removed from the femur by Dr. Halsted (Figs. 5 and 6).

FIG. 1.

Pathol. No. 4993. Bone cyst of humerus: no connective-tissue lining. White female aged seven years; history of fracture one year ago with healing; recent fracture four days, pain and loss of function; 1903 curetting (Bloodgood); 1910 well. See Fig. 2. *X*, fracture.

FIG. 2.



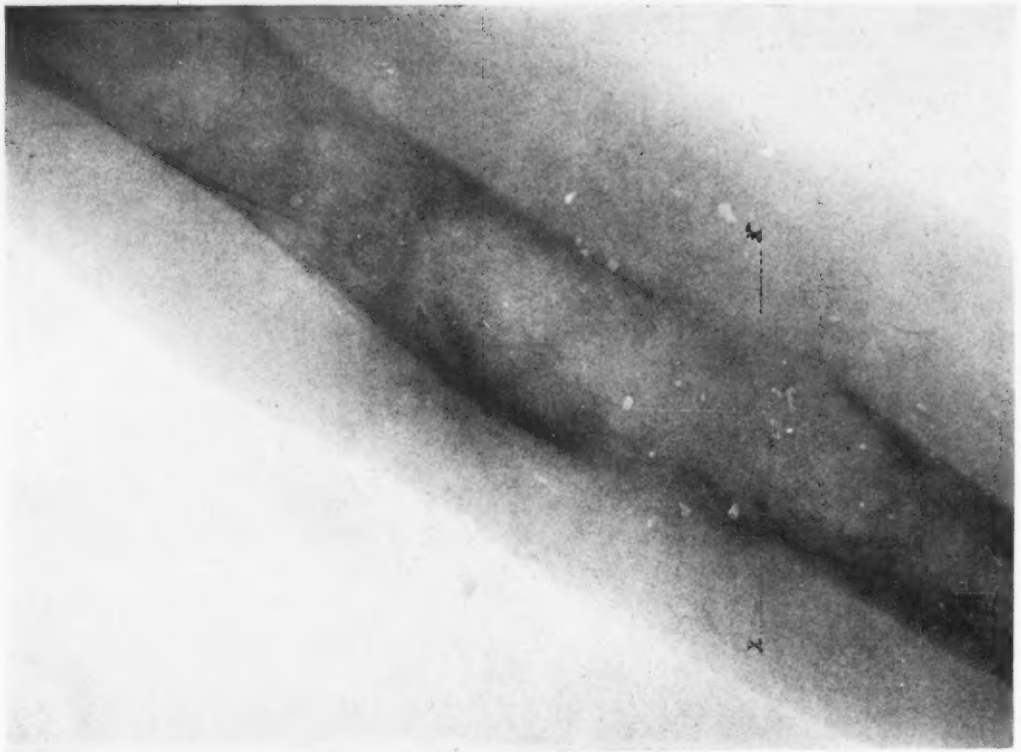
Pathol. No. 4993. X-ray seven years after operation in case illustrated in Fig. 1.

Fig. 3.

Pathol. No. 9155. Bone cyst of humerus. White male aged thirteen years. Expansion of humerus after injury (fracture) two years ago; this slowly increased. Recent injury five days; no evidence of fracture. Curetting by Dr. Eisendrath of Chicago. Definite connective-tissue wall. Well nine months since operation. As compared with Fig. 1 the cyst does not extend to the upper epiphysis; there is evidence of an old healed fracture at *X*.

pictures see Figs. 22 and 23.

FIG. 4.




Pathol. No. 10474. Bone cyst of humerus with thick connective-tissue lining. White male aged eighteen years; pain three weeks fracture after a slight trauma three days. Note the extensive involvement with but a slight degree of expansion in contrast of an X-ray of a giant-cell sarcoma or a more malignant medullary sarcoma. The bone capsule is destroyed in some places (*X*). Curetting by Dr. Sowers of Washington. Recent case. For microscopic pictures see Figs. 22 and 23.

FIG. 5

Pathol. No. 5358. Ostitis fibrosa of the upper half of the femur with a small bone cyst. White boy aged seven years; fracture four and one-half years; limp since; recent expansion of the upper portion of the femur; loss of function ten days since slight trauma. The X-ray shows the slight expansion of the femur, but the central shadow is more opaque than in Figs. 1, 3, and 4. Operation March, 1904, by Dr. Halsted: subperiosteal resection of upper half of femur. See Fig. 6.

4. In this variety (7 cases) there are no cysts. The distended shell of bone is filled with fibrous tissue. I had the opportunity to personally study an example through the courtesy of Dr. Kammerer of New York, who was good enough to send me not only his X-rays (Fig. 7), but also the tissues (Fig. 8) he removed by curetting.

5. In this variety (5 cases) the pathologic picture is somewhat different: there is neither a single cyst, nor a solid mass of fibrous tissue, but the distended shell of bone is partitioned into multiple cavities which either contain fluid (cysts) or fibrous tissue (ostitis fibrosa). Here I have also had occasion to investigate carefully one case, operated on by Dr. Follis in Prof. Halsted's clinic (Figs. 9, 10, 11, and 12).

6. Here I have collected some miscellaneous cases. In one operated upon by Dr. Finney, the cyst in the lower end of the humerus had become infected and had broken through the shell of bone involving the elbow-joint. There are five cases in which there were X-ray studies only. The X-ray of one of these was sent to me by Dr. Colvin of St. Paul (Fig. 13). In three cases I have specimens or photographs of specimens: one sent me by Dr. Roswell Park of Buffalo (Fig. 14), one from Lebert's Atlas (Fig. 15), and one, a specimen given me by Dr. Cotton of Baltimore (Fig. 16). These are single cysts of unusually large size which differ from the majority of the other cases by the abruptness of the bone expansion and the thickness of the bone shell (Figs. 14, 15, 16, and 17). The clinical history of Dr. Cotton's case I have in detail. Two cases are examples of healed bone cysts (Fig. 18), in which the cavity is filled with normal cancellous bone: one of these is an observation of my own. The last cyst I have placed in a group by itself, because it represents the only one, as far as I could make out, in which the patient suffered from any general disease which might be looked upon as an etiological factor. This is a cyst reported by Fraenkel in 1904 in which the patient suffered from scurvy of the infantile type.

We may, therefore, summarize the varieties of Group A as follows:

1. Single cyst, bony shell, no connective-tissue lining, 16 cases.

2. Cyst with a definite connective-tissue lining varying as a rule from 1 to 2 mm.; in Sowers's case 8 mm., 22 cases.

3. A small cyst or cysts in a solid mass of ostitis fibrosa, 6 cases.

4. No cysts, but the bone shell is filled with a solid mass of ostitis fibrosa, 7 cases.

5. Multilocular cysts, 6 cases.

6. Miscellaneous: (*a*) infected, 1 case; (*b*) X-ray studies only, 5 cases; (*c*) autopsy specimens, 3 cases; (*d*) healed bone cysts, 2 cases; (*e*) cysts in infantile scurvy, 1 case.

These cases have in common the presence of an inflammatory tissue in the medullary cavity (ostitis fibrosa), which, with or without cyst formation, is replacing the marrow and cancellous bone producing absorption of the outer table and associated with more or less distention of the thin bone shell. Unless there has been a pathologic fracture, or the cysts are of huge size and long duration, the periosteum is normal and there is little or no new bone formation.

In a few of these cases here and there islands of *cartilage* (Fig. 19) are found. This is more often seen when the cyst is adjacent to the epiphyseal cartilage, but cartilage is never present in sufficient quantity to justify the conclusion that the cyst is due to the liquefaction of a primary or original solid area of cartilage.

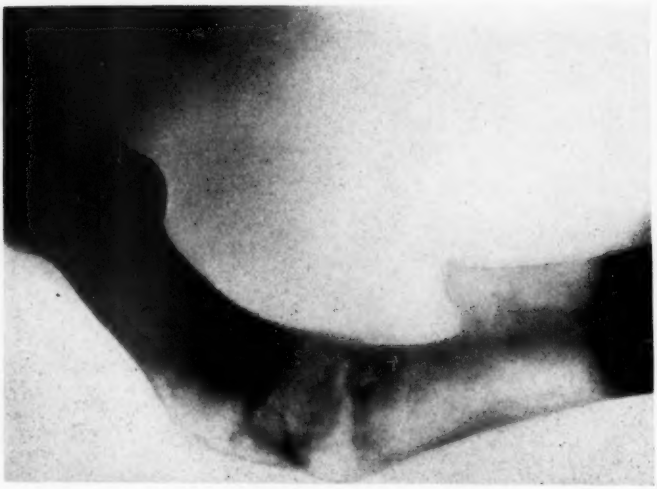
In all the cases which I have studied personally, and as far as I can ascertain from reading the literature, the fluid contents of the cyst is never distinctly hemorrhagic; it is usually thin, dark-brown in color, and contains under the microscope blood pigment and blood-cells. When opened the fluid is never under great tension; there may be a few blood coagula floating in the fluid, but this is not a prominent feature; sticking to the bone shell of the first variety, or the connective-tissue membrane of the second, there may be red, blood-stained masses which under the microscope show organized blood-clot and ostitis fibrosa.

*Giant cells* have been found in a few cases in this organized

FIG. 6.

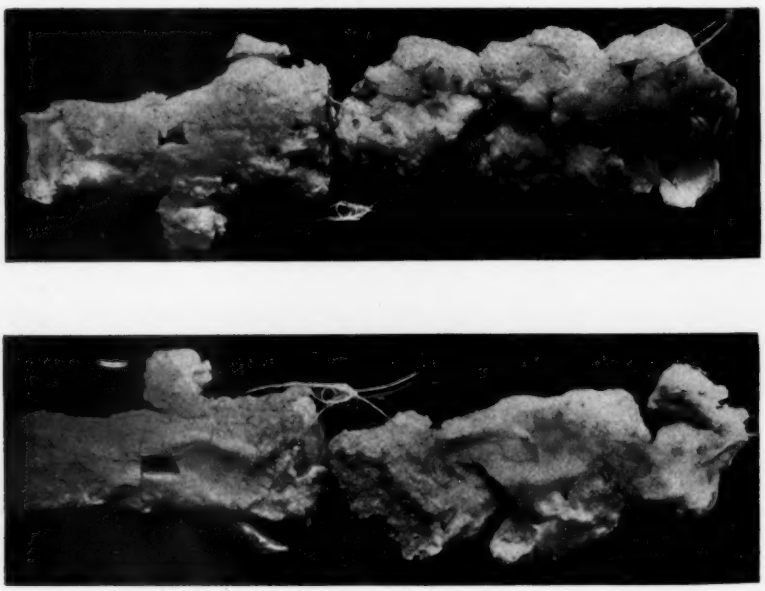
Pathol. No. 5358.—The specimen removed in the case illustrated in Fig. 5. *Cg*. cartilage near epiphysis; *o.f.*, ostitis fibrosa; *Cy*, cyst. The bone shell is everywhere preserved. April, 1910, six years well. Complete restoration of femur from periosteum.

FIG. 7.



Pathol. No. 5699. Ostitis fibrosa of femur, no cysts. White male under twenty years of age; fracture some years ago; for five months since heavy lifting pain, limp, angular deformity. The X-ray shows a shadow similar to Fig. 5, and a pathologic fracture. The solid fibrous tissue filling the marrow cavity of the femur was removed with the curette by Dr. Kammerer of New York in November, 1903. 1910—six and one-half years well. See Fig. 8.

FIG. 8.



Pathol. No. 5699. Specimen removed by Dr. Kammerer from case illustrated in **Fig. 7**. This is the gross appearance of ostitis fibrosa. Compare with Fig. 6.

FIG. 9.

Pathol. No. 5533. Photograph of patient four years after onset of swelling when first admitted to the clinic and when she refused amputation. For condition six years later see Fig. 9a.

FIG. 9a.

Pathol. No. 5533. Huge multilocular cyst of lower end of femur. Photograph of patient ten years after onset of swelling. Colored female aged thirty-two years at onset of disease. Operation, June, 1904. Partial excision and curetting; death from hemorrhage. See Figs. 9, 10, and 11.

FIG. 10.

Pathol. No. 5533. The X-ray of the patient illustrated in Fig. 9.

blood-clot (Fig. 20), but more often they are found near the lamellæ of the bone shell (Fig. 21); these giant-cell areas, except in one or two cases, have never been present in sufficient numbers to characterize the picture as a giant-cell sarcoma. In a few cases (none of which I have observed personally) the reporter has looked upon the giant cells as an indication of tumor formation. But in these cases the same perfect healing has followed mere curetting.

I mention here prominently in the introduction the character of the fluid, the peculiar connective tissue within the bone shell, and the normal periosteum, because it is these factors which of themselves alone allow one to make a positive diagnosis at the exploratory incision and to limit the operation to simple curetting.

Suggestive, it must be admitted, is the clinical history and X-ray picture, but in spite of this the differential diagnosis excluding the medullary giant-cell sarcoma, or the other, more malignant medullary tumors, has been, and must be, made at the exploratory incision.

The microscopic histology (Fig. 22) of ostitis fibrosa is sufficiently clear to differentiate it from sarcoma. The presence of cartilage (Fig. 19) which is not often found, except when many sections are made, can be looked upon as further evidence of the benignity of the lesion. The presence of giant cells (Figs. 20 and 21) is interesting, but should not confuse the investigator and should not be interpreted as giant-cell sarcoma.

These gross and microscopic characteristics of the benign bone cyst and ostitis fibrosa differentiate them from the second group of cysts, from giant-cell sarcoma, and from bone aneurisms. Before proceeding with the detailed study of the benign bone cyst and ostitis fibrosa, it seems better to consider the second group of bone cysts.

*Group B.*—Cyst due to conditions other than ostitis fibrosa. Of Group A there are 69 cases, of Group B 20 cases, which are divided into the following six varieties:

7. Cysts in cartilage tumors or enchondromas, 4 cases.
8. Pure myxomas with or without cysts, 5 cases.

9. Cysts in giant-cell sarcoma, 4 cases.

10. Cysts in arthritis deformans or ostitis deformans, 4 cases.

11. Cysts due to a subperiosteal hæmatoma with a bony wall due to ossifying periostitis, 2 cases.

12. Callus cysts, 1 case.

As compared with 69 true bone cysts I find, therefore, in the literature at least 20 cases of benign lesions which in the X-ray resemble somewhat the bone cyst, but which differ at the exploratory incision. They, however, must be considered in the differential diagnosis, and here we meet with no particular difficulties.

The enchondromas of Group 7 are chiefly of historical interest. True central enchondromas of the long pipe bones must indeed be rare lesions, because in spite of the repeated attempts to prove Virchow's view, we find in the literature to-day—thirty-four years after Virchow's publication—but four cases. Virchow at an autopsy in 1876, upon a woman aged 56, found a small cyst in the upper end of the humerus; there had been no clinical symptoms and there was no expansion of bone. He describes fibrocartilage and fibrous connective tissue in the wall of the cyst. Zeroni in 1903 confirmed Virchow's observation. The case is mentioned by Koenig, but I cannot get the original. Fleischhauer in 1905 found in the crest of the ilium of a girl aged 20 a multilocular cyst with clear fluid and cartilage in the wall. Riedel in 1906 reports two cases—an island of cartilage in the tibia and one in the lower end of the femur. The majority of recent publications on bone cysts regard these four cases as accidental findings, and conclude that they have no relation whatever to the true bone cysts.

*Group* 8.—Pure myxoma without cysts: This is an interesting group. In all the five cases the tumor occupied the medullary cavity of the phalanx. Baer's case I have examined histologically, and it was cured by curetting. Dreesman, as also Blake, curetted, Codman resected, Bostroem amputated. The curetted patients have remained well. This operation should be looked upon as sufficient. The X-ray does not differ

from a cyst, but so far cysts have been seen in the phalanx only in those cases in which multiple cysts have been present in other bones. The age of onset of these medullary benign myxomas of the phalanges has varied from three to thirty-nine years, the duration of the tumor from one to eighteen (Blake's case) years. Pure myxomas are rare bone tumors. I have observed one exhibiting itself as an exostosis of the shaft of the humerus, another in the medullary cavity of the upper end of the humerus; I have seen it combined with cartilage as a multiple lesion arising from the rib, and as a periosteal growth from the os calcis. I shall discuss these pure myxomas in a second contribution on bone tumors.

*Group* 9.—Cysts in giant-cell sarcoma: In my personally observed 19 cases of giant-cell sarcoma I have seen cysts in but two. In the contributions on bone cysts, four cases are mentioned as cysts in giant-cell sarcoma. In all of them, except Tietze's case, the data are somewhat incomplete. Chiari in 1878 has reported a giant-cell sarcoma in the sacrum with cyst formation. Koenig observed two cysts in the medullary cavity of a clavicle in young girls, Koerte in the upper end of the femur; this case was cured by curetting. Tietze's tumor was situated in the fibula; the patient was 35, and the tumor had been present one year; it was about the size of a cherry; the symptoms were pain and swelling; the bone was resected; the result is not given.

Without further details it is difficult to know where to place these tumors. I am inclined to view them as very small giant-cell sarcomas. It is interesting that in one case in which the ultimate result is known, the patient has remained well. These tumors might be difficult to distinguish from bone aneurisms.

*Group* 10.—Cysts in arthritis deformans and ostitis deformans: I have observed one case and find three in the literature.

It is interesting to note that all of the patients are over 50. In the one which I studied (Pathol. No. 5807), the cyst was confined to the great trochanter of the femur; the patient was 70; there had been pain, tenderness, and swelling of the trochanter two years after a trauma. The shadow of the cyst

in the X-ray was distinctly irregular. At operation it resembled a large marrow cavity; there was no connective-tissue lining, but the surrounding bone showed both sclerosis and lipomasia. Braun found a cyst in the neck of the femur in a decrepit female aged 78 who two years previously had a fracture of the neck of the femur; the cyst contained a reddish fluid and fat drops. Microscopically, the bone showed osteoporosis and osteoclast giant cells. Schmieden's cyst was situated in the lower end of the femur in a female aged 58 whose knee was resected for arthritis deformans. The details of Ziegler's case I was unable to obtain.

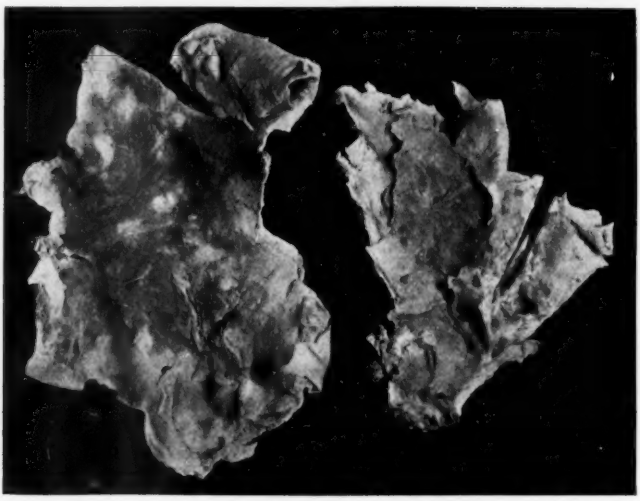
These cysts will never be confused with the simple cysts in younger individuals. If there is but one lesion, as in my case, a tumor would have to be considered. The diagnosis can easily be made at the exploratory incision.

*Group* 11.—Cysts due to periosteal hæmatoma with an osseous wall, two cases: Deetz observed in a male, aged 18, three months after a trauma to the hip a tumor the size of a child's head. At the exploratory operation there was a large cavity filled with coagulated blood; it had a definite bone wall due to ossification of the periosteum. As the patient died six months later of heart disease, Deetz was able to obtain at autopsy the specimen which he illustrated. Glimm observed in a male, aged 25, a similar condition; there was a history of trauma to the right tibia eighteen months before; the trauma must have been a considerable one, because the patient was confined to bed three weeks, and the swelling never disappeared. At the exploratory operation there was a periosteal bone shell of 3 mm. thickness, and a cavity filled with blood. These two cases are of interest in studying the differential diagnosis of periosteal formations. Ossifying periostitis may follow trauma and is very frequent in syphilis. There is also an ossifying periosteal sarcoma which is relatively benign. The more malignant periosteal sarcomas may be associated with bone formation. I have had a recent observation of this kind. So far I have been able to note only these two cases of Deetz and Glimm in which cyst formation due to hæmatoma has been present in the traumatic ossifying periostitis, and I

FIG. 11.

Pathol No. 5533. The specimen obtained at autopsy in case illustrated in Figs. 9 and 10. This shows the thick outer bone wall and one of the larger septa which is ossified only a few millimetres near the bone shell. See Fig. 12.

FIG. 12.

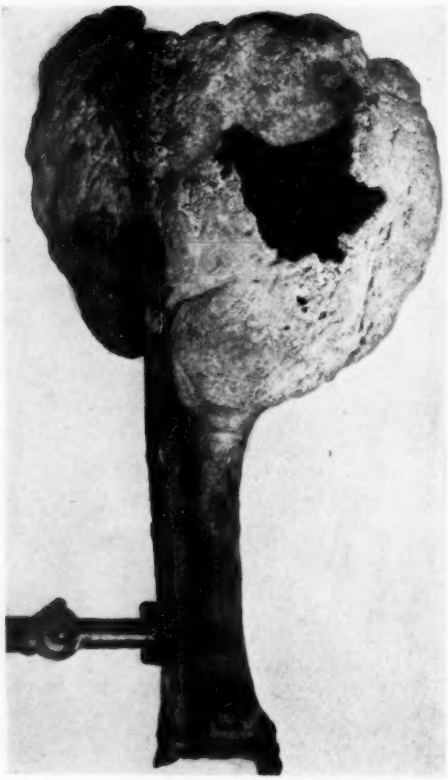


Pathol. No. 5533. Thin partitions separating the cysts in case illustrated in Figs. 9, 10, and 11. This tissue resembles ostitis fibrosa. It varies in thickness from 3 mm. to that of transparent parchment paper; areas of cartilage were not found, but there are a few giant-cell areas which can be seen in the gross as darker, somewhat pigmented areas.

FIG. 13.

Pathol. No. 9025. Bone cyst of upper end of ulna. Girl aged six years; swelling seven months. First X-ray by Dr. Colvin of St. Paul in December, 1904. This X-ray was taken April, 1906, one year and three months later; there has been very little change during this time. In March, 1909, four and one-half years, Dr. Colvin informs me that the cavity of the cyst is filling with bone trabeculæ; the expansion is still present.

FIG. 14.



Pathol. No. 6021. Specimen sent me by Dr. Roswell Park of Buffalo. Abrupt expansion and thick wall of this cyst resemble the condition illustrated in Figs. 15 and 16.

shall have to leave to another paper the consideration of this group of cases. The benign bone cyst is never a periosteal lesion.

*Group* 12.—Callus cysts of bone: Frangenheim observed a very interesting cyst in an old fracture of the neck of the femur. Apparently it was due to an attempt at marrow formation in callus. From the clinical picture and the X-ray, there should be no difficulty in recognizing the lesion which he pictures.

### CLINICAL PICTURE OF BENIGN BONE CYSTS AND OSTITIS FIBROSA.

*Age of Onset.*—The bone cyst and ostitis fibrosa is distinctly, as Von Mikulicz observed at the German Surgical Congress of 1904, a disease of the youthful individual. Among my 69 cases there are but five in which the age of onset was over 20 years. These five cases are worthy of a more detailed study, because this reduces the actual number of cases in which the patients were older than 20 when the disease was first noted. Bostroem's case was reported in 1883. I have placed this case in my fifth variety, because it was a multilocular cyst; it had an unusual position,—the sacrum,—and was found at autopsy; the age of the female patient is given as 25, but as there is no note as to the duration of the tumor, the onset of the lesion may have been before 20. Pfeiffer's patient was 21 when the first symptom appeared, and it is quite possible from the nature of the case that it had been present longer. Simmons's patient was 28. One of my personally observed patients was 33; here we had a multilocular cyst of the lower end of the femur. Koenig's patient was 40; she was admitted with a recent fracture of the neck of the femur, and the ostitis fibrosa present in the upper ends of both femora was found at the autopsy.

I emphasize the fact that this disease, with the rarest exception, begins before 20, that is, before complete ossification of the epiphyses. Mueller, in tabulating 42 cases, notes 15 between the ages of 20 and 59. I am inclined to think that he

has included in this table cysts due to other causes, or he has not subtracted from the age of the patient at the time of observation the duration of the disease. My investigation, therefore, thoroughly agrees with that of Von Mikulicz as to the youthful age of the patients at the onset of the disease. The youngest patient was 2½; up to 10 years of age there are about 21 cases; between 10 and 15 about 15 cases; between 15 and 20, 11 cases. The age of onset, therefore, in the majority of cases is under 15.

In my personally studied cases of all bone lesions I find that in patients under 10 years of age there are five examples of exostoses, one of medullary giant-cell sarcoma, and two of periosteal spindle- and round-cell sarcoma. Of course, any conclusions based upon the statistics of one clinic are insufficient, but it is interesting to note that in individuals under 10 years of age the medullary lesions are either benign bone cysts with ostitis fibrosa, or the not very malignant giant-cell sarcoma. However, even in my small group between the ages of 10 and 20, I find every variety of malignant medullary tumor, so that between these ages the age of onset is no help in the differential diagnosis.

*Duration of the Tumor.*—In the study of my personally observed cases of sarcoma, I find a very interesting observation, that is, in the more malignant forms of sarcoma of bone, both periosteal and medullary, not a single case has come under observation after the tumor had been present two years. This is due to the fact that the pain and swelling of the more rapidly growing malignant tumor forces the patient to seek advice early, and, second, because the disease usually causes death by metastasis within two years, while with the benign bone cysts and ostitis fibrosa, pain is rarely a prominent symptom and swelling, as a rule, is a late symptom; the patient generally seeks advice because of the disability of a pathologic fracture. In the early cases, the pathologic fracture may have been the first symptom, and it is quite possible that the disease had been present a longer time. When one studies the X-ray of these cases and views the size of the cavity, it is

difficult to imagine that it is a lesion of less than one or two years' duration. For example, in one of my cases referred to me by Dr. Leary of Boston (Fig. 19), the child was perfectly healthy and the cyst was only found at the routine examination made for fracture. If we assumed this cyst to have begun at the time of the fracture, it would have been of but five days' duration. The only factor in the clinical history which allowed any deduction at all was the statement that the child had received a contusion to the humerus two years previously, but had complained of discomfort only a few days. The incident that brought the child under observation was a fall and fracture of the humerus. The cyst involved the upper half of the shaft. How long, shall we say, have the symptoms been present? So that in the table of the duration of the disease of these cysts and ostitis fibrosa it is quite possible that the trouble was present many months before it had given any evidence of its existence.

Among the cases of bone cysts and ostitis fibrosa and Group B—cysts due to other conditions—the duration of the disease in 30 cases is estimated as less than two years, and in 29 cases from two to ten years or more; there are 14 cases of less than six months' duration, 6 cases between six months and one year, and 10 cases between one and two years; there are 11 cases between two and five years, and 18 in which the symptoms had been present over five years. We might, therefore, state that in at least 29 cases the more malignant medullary sarcomas could be excluded by the duration of the disease, but medullary giant-cell sarcoma cannot be excluded. In my personal study of 19 cases which I shall also take up in this paper, the duration of the disease in 7 varied from two to nine years.

*Symptoms of Onset.*—Pain, swelling, and fracture are the symptoms. Fracture predominates. For example, in the 14 cases of less than six months' duration, 9 gave a history of fracture as the first symptom; pain without fracture was present in but 3; in only one did the patient seek advice because of swelling only. That is, in the 9 cases of fracture the

patients sought advice, because after the fracture, in a few, an X-ray revealed the cyst; in others, after the usual healing of the fracture, there was sufficient expansion of bone to indicate that a condition was present different from that to be expected after the healing of an ordinary fracture.

In the group in which the symptoms had been present from six months to one year, in 3 cases the condition was referred to a fracture, in 3 there was swelling only. In the group in which the symptoms had been present one to two years, fracture is mentioned four times, pain without fracture four times, swelling twice. In those patients in whom the symptoms had been present from two to five years, fracture was the symptom of onset in 8, a few had recurrent fractures; swelling alone was noted in 1 case, and pain in 2. In the 18 cases in which the symptoms had been present more than five years, fracture was the symptom of onset in 10, pain in 1; this patient had had pain ten years and a pathologic fracture ten days. In 3 cases there was swelling only, without fracture; in 2 there was a limp with slight curvature. This is the first time that I meet with limp as the symptom of onset. Both of these cases belong to the fourth variety—ostitis fibrosa of the femur. Here apparently the patients were unaware of the disease until the bending produced shortening and limp. In one case the symptom of onset was arthritis of the knee (Pfeiffer's second case); here the patient, aged 41, suffered from what was called arthritis of the knee at the age of 17; the cavity was at the lower end of the femur. In the healed bone cyst of my own observation, in which the swelling had been present twenty-two years, from the vague history of the patient one would infer that the first symptoms of the trouble were signs of infection.

These findings demonstrate how insidious the pathological process in the medullary cavity may be until a slight trauma produces a fracture. Even then the fracture heals, and the patient may not return under observation for years. Therefore, it may be fair to conclude that in all of these cases the only prominent etiological factor is a trauma, but we have no

FIG. 15.

Pathol. No. 7374. Photograph of a bone cyst of the upper end of the tibia taken from Labert's Atlas, p. 167, also sent me by Dr. Park of Buffalo.

FIG. 16.

Pathol. No. 8324. Photograph of a bone cyst of the lower end of the femur, removed by amputation. Longitudinal section through femur, cyst, and tibia. Note the abrupt expansion, the thick bone wall, and the single cyst. Compare with Figs. 14 and 15. The clinical picture and X-ray (Fig. 17) resemble the case illustrated in Figs. 9 and 10, but the cyst was single with a thick connective-tissue wall, and not a multiple cyst. The patient when she first observed the swelling was twenty years of age. The amputation was performed eleven years later by Dr. Cotton of Baltimore, because of hemorrhage after curetting the cyst. The patient recovered.

FIG. 17.

Pathol. No. 8324. X-ray of case illustrated in Fig. 16, made three and one-half years after the onset of the swelling. In the following seven and one-half years before operation there was very little increase in size.

FIG. 18.

Pathol. No. 9718. Healed bone cyst lower end of fibula. Female aged forty, onset of swelling at age of sixteen; no symptoms for years. (Exploratory operation, Bloodgood.) The result in Colvin's case (Fig. 13) apparently resembles this.

positive evidence that the disease had its onset after the trauma. In fact, the evidence can be interpreted that the trauma simply reveals what has been present a longer period of time.

I, therefore, have been unable to find any definite etiological factor, and I cannot agree with those who look upon the lesion as the result of trauma, but it cannot be denied that there is some justification in considering the possibility of traumatism as a factor.

I agree with all the more recent investigators that the disease is an inflammatory one, in which the medullary tissue is replaced by a new formation of connective tissue with or without cyst formation, and that the term ostitis fibrosa is not an inappropriate one, although it would appear that the term chronic osteomyelitis fibrosa cystica or solida would describe the condition more fully.

*Results of Treatment.*—Curetting 38 cases, osteotomy for bending 3 cases, resection 6 cases, amputation 3 cases; no note 4 cases; autopsy specimens 5 cases. In 9 cases, therefore, an unnecessarily extensive operation was performed.

Among the cases subjected to curetting there are two deaths from hemorrhage and one in which it was necessary to amputate on account of the hemorrhage. Bockenheimer reports a huge cyst in the upper half of the shaft of the femur of at least twelve years' duration in a girl aged 17. Mikulicz had operated on this patient when she was 14; he simply injected iodoform without curetting; this individual also had a cyst of the tibia; the recurrent cyst was apparently of large size and belonged to the type in which there is no definite connective-tissue wall. Bockenheimer states that after curetting there was oozing and death. The other two cases have been mentioned before (see Figs. 9 and 16).

In the remaining 35 cases, as far as I am able to ascertain, there has been one definite recurrence. Koerte in 1870, after first curetting a cyst with a definite connective-tissue wall in the shaft of the femur, amputated under the diagnosis of sarcoma when the cyst reformed. Kehr curetted again in two

weeks. With these exceptions every case has remained permanently well after curetting. In my case it is seven years since the operation. Dr. Beck writes me that his two cases are well ten and seven years after operation; Dr. Corson informs me that his patient has remained well eight years. We, therefore, can feel reasonably certain of the permanency of the result after curetting.

The osteotomies have all been performed for ostitis fibrosa without cyst formation; these cases resembled the one reported by Kammerer (see Fig. 7). These operations were performed by Almerini, Von Brunn, and Whitman. In all cases the lesion was situated in the femur, and the indication for osteotomy was bending. The ultimate results in these three cases are not noted. I am inclined to venture the opinion that when bending is associated with cysts or ostitis fibrosa, curetting should be simultaneous with the osteotomy.

Resection has been performed by D'Arcis and Lexer for cysts of the femur and humerus without connective-tissue lining (my first variety). D'Arcis gives no explanation why he resected 22 cm. of the shaft, head, and neck of the femur, and implanted the fibula. Lexer resected the humerus and also filled the defect with the fibula. In his description he writes that, on exploring the cyst he found the bone shell so thin and in places entirely destroyed that he did not feel confident that simple curetting would accomplish a permanent cure, but might lead to later bending and refracture; for this reason he performed a subperiosteal resection. His result is an unusually good one, but I am confident that it is not as good as the results obtained by simple curetting alone, and in many of the cases subjected to curetting the shell of bone has been as thin and as perforated as in Lexer's case. I emphasize this, because it is my opinion that curetting should be attempted in every case. In the very large cysts the danger of hemorrhage should be borne in mind and a technic established to prevent it.

In Mueller's and in Braun's cases the cyst contained a connective-tissue lining. Mueller resected the metatarsal bone, Braun the upper two-thirds of the humerus, and filled the

defect from the anterior surface of the tibia with a good result. In the remaining two cases, Halsted did a subperiosteal resection of the femur for ostitis fibrosa containing a small cyst (see Fig. 5), while Boetticher resected the humerus under the diagnosis of osteosarcoma without an exploratory incision. This is the only case in which resection was done because of a definite diagnosis of sarcoma.

Koerte performed an amputation in 1870 because the cyst in the femur, curetted at first, reformed. Miessner's observation was in 1884; the amputation was apparently performed because of the history of many fractures during a period of eleven years in a boy of 18; as the result of these fractures and the cyst with a definite connective-tissue lining, the femur was shortened 16 cm. There is nothing in the report to suggest that Miessner looked upon the disease as malignant. The third case subjected to amputation has already been mentioned (see Fig. 16).

*Multiple Lesions.*—Cases in my own observation and those from the literature have been observed a sufficiently long time to conclude that the bone cyst and ostitis fibrosa may be localized in one bone. Yet, in this list of 69 cases, in 4 cases more than one bone has been involved. Von Brunn observed ostitis fibrosa without cyst formation in both femora and in the right tibia; osteotomy was performed, so we have no pathological report, nor is the ultimate result noted. In a case reported first by Von Mikulicz and later by Bockenheimer on account of a recurrence, there were typical cysts without connective-tissue lining in the lower end of the femur and in the upper end of the tibia. Pfeiffer curetted zones of ostitis fibrosa without cyst formation from both femora with a perfect result, while Tietze observed in the femur and tibia ostitis fibrosa with cyst formation.

From these few cases ostitis fibrosa has been found more often than cysts in the multiple lesion.

*Location of the Cysts.*—The most common situation is the humerus, femur, and the tibia, about in the order named. In the humerus, cysts without and with a narrow connective-tissue

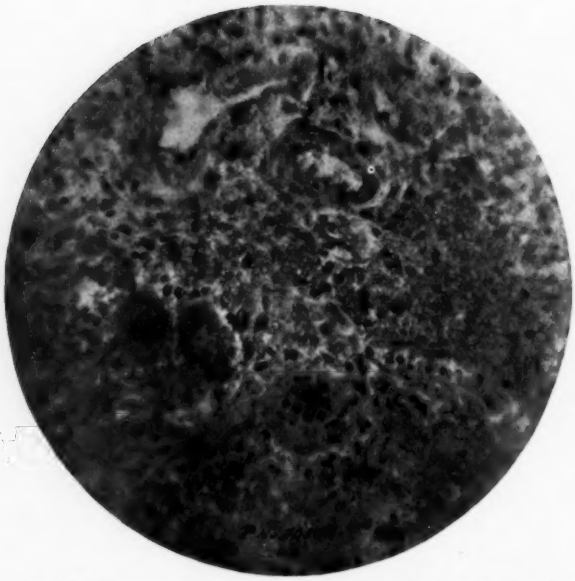
lining predominate. Ostitis fibrosa without cyst formation was observed in one case. Ostitis fibrosa without cyst formation of the type illustrated in Fig. 7 has been situated in the shaft of the femur in all cases but one. In the patient reported by Von Brunn the lesion was in the humerus; the patient was a boy aged 12 whom he saw eighteen days after an injury; a diagnosis of medullary sarcoma was made, but at the exploratory incision, after the removal of the thin shell of bone, the typical tissue of ostitis fibrosa was recognized; after curetting a cavity was left 10 cm. in length with normal marrow above and below; that is, the disease did not extend to the epiphysis; giant-cell areas were found, but no cartilage islands. Von Brunn allowed this cavity to fill with blood-clot and heal *per primam*. The result in this case eighteen months after operation, based upon function and X-ray, may be considered perfect. In two cases the lesion corresponded with variety 5 of Group A—multilocular cysts in ostitis fibrosa, similar to the case illustrated in Figs. 9 to 12. I emphasize this here, because Boetticher in his observation resected without exploratory incision, having diagnosed the lesion sarcoma. In the gross and microscopic pathology, in addition to the multilocular cyst formation, there were red and yellow areas between the septa in the expanded shell of cortical bone; the red areas resembled giant-cell sarcoma; the septa and yellow areas were histologically ostitis fibrosa; there were no islands of cartilage.

The multilocular cyst of this type is the least frequent of all the varieties of bone cysts and ostitis fibrosa: there are but five cases, because the one reported by Moenckeberg is the same case as that of Boetticher. The one described by Koenig was situated in the femur and resembled very closely my observation (see Fig 9.). Bostroem observed a similar pathologic condition in a sacrum at autopsy. Schmorl's case is incomplete. Ostitis fibrosa, therefore, is seen more often as a single cyst with or without any remains of connective-tissue lining,—38 cases,—or as a solid mass of fibrous tissue with or without small cysts—13 cases. The small number of the multilocular cysts—5 cases—should be emphasized, because

FIG. 19.

Pathol. No. 10275. Photomicrograph by Schapiro, showing islands of cartilage in the bone shell in which the bone lamellæ are separated by ostitis fibrosa. Patient of Dr. Leary of Boston. White girl aged five and one-half years, contusion of humerus two years without symptoms; recent injury (three days), fracture. X-ray very much like Fig. 1. Cyst in humerus extending to epiphysis. Operation January, 1910, curetting. The cyst contained no connective-tissue lining.

FIG. 20.



Pathol. No. 10352. Giant cells in a hemorrhagic area of ostitis fibrosa. Bone cyst of the humerus in which there was a definite connective-tissue lining. (Eisendrath's second case.)

FIG. 21.

Pathol. No. 10352. Photomicrograph (high power) of the bone shell (*b*), the giant-cell osteoclasts (*g*), and a very vascular area of the connective-tissue lining. (Eisendrath's second case, see Fig. 20.)

FIG. 22.

Pathol. No. 10474. Photomicrograph (low power) from section of bone shell and connective-tissue lining (Sowers' case, see Fig. 4). Note the giant-cell osteoclasts producing bone absorption.

FIG. 23.

Pathol. No. 10474. Photomicrograph (low power) from section of the bone shell in Sowers' case (see Figs. 4 and 22). Here the ostitis fibrosa is filling the spaces between the bone lamellæ, and there are minute cyst formations (*C*), suggesting the origin of the larger cysts.

the differential diagnosis from myxochondrosarcoma might at first sight seem difficult.

In the femur every type of cyst has been observed; in the tibia the cysts of varieties 1 and 2 predominate; there is but one example of the solid ostitis fibrosa, and in this instance (Von Brunn's case) the femur was also involved; there is also one example of variety 3, that is, the ostitis fibrosa with small cyst formation; here also the femur was involved.

The benign bone cysts of varieties 1 to 5, therefore, are found prominently in the humerus, femur, and tibia; more often they extend to the epiphyseal line, but there are cases in which the disease involves the centre of the shaft only.

Colvin reports an X-ray of a benign bone cyst of the ulna. I find no recorded examples of cysts of any kind in the radius or in the metacarpal bones. The cases in the literature in which the cyst has been observed in the phalanx (X-ray) (Group B, variety 8) have all proved to be pure myxomas. In the clavicle I find no examples of bone cysts. Koenig reports two cysts in giant-cell sarcoma situated in the clavicle.

There is not an example of a true bone cyst in the pelvis. I have classified Bostroem's autopsy observations in variety 5—the multilocular cysts. The patient was a woman aged 25 who died after Cæsarean section; the cystic tumor filled the pelvis; it had a distinct bone shell and measured 4 x 11 x 11 cm.; the septa were both fibrous and cartilaginous. This observation could just as easily be grouped with my variety 7—cysts due to the liquefaction of solid cartilage tumors. Fleischhauer has reported such a cyst in the ilium of a girl of 20, and classifies it with Virchow's type. Chiari records a cyst in giant-cell sarcoma of the sacrum, and Deetz reported a cyst of the ilium due to a subperiosteal hæmatoma with ossification.

Practically, therefore, we can exclude the pelvis from involvement in the true cyst. I have observed a healed cyst in the lower end of the fibula (see Fig. 18). Mueller records a typical bone cyst with a connective-tissue lining in one of the metatarsal bones. Bostroem observed in the cadaver of a male aged 30 a cyst with a definite connective-tissue lining in the os calcis.

The localization of the single cysts in ostitis fibrosa is much more marked than when the disease is multiple in many bones. In the latter disease, phalanges of fingers and toes and other unusual sites have been the seat of the disease.

MULTIPLE CYSTS, OSTITIS FIBROSA, AND GIANT-CELL SARCOMA.

There is no doubt that the bone cyst, ostitis fibrosa, and the giant-cell sarcoma may be a disease localized to one bone. There are, however, examples of very similar pathological conditions affecting many bones. For this reason, whenever a patient comes under observation with clinically a single bone lesion, examination should be made as a routine practice with the X-ray for other bone lesions, and the urine should be examined for Bence-Jones bodies the finding of which, up to the present time, is considered a pathognomonic sign of multiple myeloma.

I have divided these multiple lesions into the following groups:

1. Multiple cysts in ostitis fibrosa: Von Recklinghausen's disease—twelve cases.

2. Multiple cysts in ostitis deformans: Paget's disease—five cases.

3. Multiple cysts in osteomalacia—six cases.

4. Multiple cysts in enchondroma: Virchow's type—two cases.

5. Multiple cysts in sarcoma—one case.

6. Multiple cysts in mercurial poisoning—one case.

I find no example in the literature of cysts in the multiple lesion myeloma. In practically all of the recorded instances of Von Recklinghausen's ostitis fibrosa of the entire skeleton cysts have been observed, while in Paget's disease and osteomalacia cyst formation is rather the exception than the rule. The multiple tumors—enchondroma and sarcoma—are of themselves very rare lesions. How often they occur without cyst formation I have not had the opportunity to ascertain.

Just what the practical side of these multiple lesions of bone will be in the future I am not prepared to state, but as the patients may live many years, perhaps we will learn from ex-

perience that operative intervention may give relief, prolong life and perhaps, in some cases, accomplish a cure.

*Multiple Cysts in Ostitis Fibrosa.*—This general disease of the skeleton was first described by Hirschberg in 1889, but he looked upon the lesion as osteomalacia with cyst formation. The disease for this reason owes its recognition and name to the contribution of Von Recklinghausen in 1891. In all of these cases there has been cyst formation; in seven out of the twelve multiple giant-cell tumors were also noted. I have been able to show that in the local lesion cysts are found with the rarest exceptions and giant-cell areas are frequently seen in the microscopic sections and sometimes in the gross.

In the disease affecting the general skeleton the cyst formations are apt to be smaller and the giant-cell areas more numerous and larger. The symptom of onset as a rule is observed later. In about five out of twelve cases the patients were over twenty, two over fifty; the remaining seven were under twenty. Von Haberer's patient was three at the onset. The duration of life has varied from eighteen months to eighteen years, during which time the patients have suffered from one or more fractures, bending of the bones and multiple swellings. They frequently complain of so-called rheumatic or joint pains, and death takes place under the picture of marasmus. Although giant-cell tumors are found in many bones, in not a single instance has metastasis to internal organs been found. Rehn's contribution is one of the best because of a full pathologic study. The case published by Crile and Hill is the only one in American literature, except those discussed in my contributions to "Progressive Medicine." Crile and Hill interpret their observation as multiple giant-cell sarcoma, but it seems to me that it belongs to the group of Von Recklinghausen's disease.

*Multiple Cysts in Paget's Disease.*—There is considerable confusion in this smaller group, and all of these cases may really be Von Recklinghausen's disease. The patients are older, although Sonnenberg, in reporting three cases, observed one at sixteen years of age; the other two were aged sixty-one and forty-seven. In these cases the diagnosis was based on

the study of the X-rays only. Daser also offers no anatomical proof for his diagnosis in a woman of fifty who had had symptoms of the disease fifteen years. The only observation I have been able to find recorded in American literature is by De Forest Willard and Andrus. Here also there is no anatomical proof. Kolisko is the only one with full anatomical study at autopsy, and he brings out the fact that giant-cell sarcomas are not always present.

*Multiple Cysts in Osteomalacia.*—The observations of Engel and Hirschberg are complete, both in the clinical history and autopsy. Clinically, Engel's case suggested osteomalacia: the patient was forty-two at the onset and lived thirteen years; the symptoms were emaciation, weakness, pain in the bones, and, some years before death, multiple fractures; the patient was bed-ridden. At the autopsy cysts from the size of a lentil to that of a hen's egg predominated in the picture; they were found everywhere—in the epiphyses and diaphyses, in long and short pipe bones and in flat bones; the largest cysts had a fibrous membrane; expansion of bone about the cysts was practically absent; there were no giant-cell tumors. Histologically, the tissue in the wall of the cysts corresponded more with ostitis fibrosa than with osteomalacia. Engel's observation was made in 1864, later Heinecke interpreted it as osteomalacia. Hirschberg's case observed in 1889 also allows more than one interpretation. Von Haberer classifies it with Von Recklinghausen's disease, Hirschberg himself with osteomalacia. Giant-cell tumors were present in this case. The disease had been present four years in a woman of thirty-five. It is rather interesting to note that the symptom of onset was swelling of the left clavicle; symptoms of other foci developed rapidly. Heinecke's case is most interesting on account of the X-ray studies. Clinically, the patient was twenty-four with symptoms of four years' duration following trauma to the left hip; she came under observation with pathological fracture of the left femur; the X-ray showed the multiple cyst. At the operation on the left femur Heinecke found a cyst with a connective-tissue lining. Heineke interprets the microscopic picture as osteomalacia.

FIG. 24.

Pathol. No. 4520. X-ray of giant-cell sarcoma of upper end of tibia (Bloodgood's case). Well seven years and five months after curetting. The shadow here is more like that of a bone cyst,—it has not the usual abrupt expansion of the giant-cell tumor.

FIG. 25.

Pathol. No. 4520. X-ray three months after operation in case shown in Fig. 24.

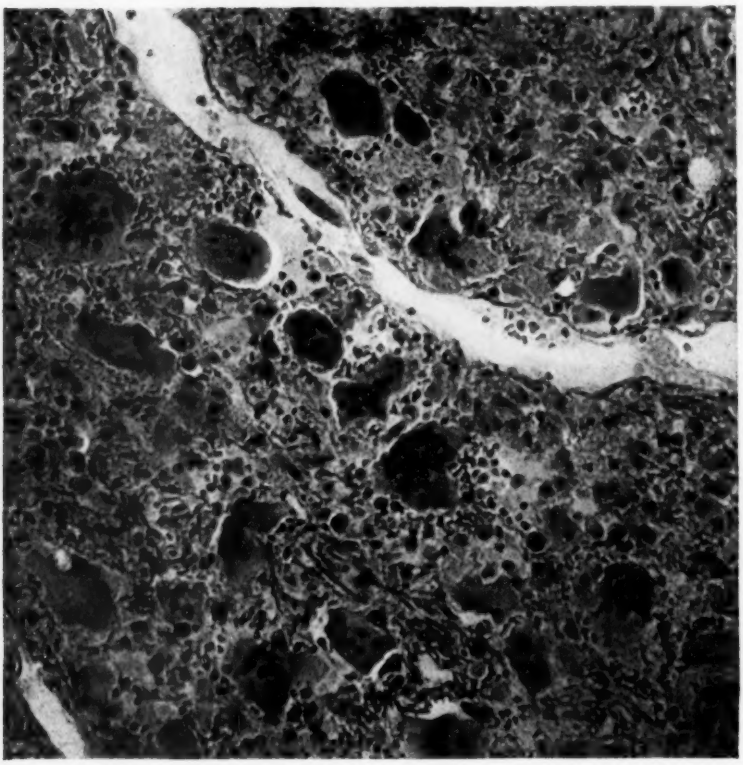
FIG. 26

Pathol. No. 4520. X-ray three years after operation in case shown in Figs. 24 and 25.

FIG. 27.

Pathol. No. 4520. Part of the tissue removed from the medullary cavity in the case illustrated in Figs. 24, 25, and 26. Note the broken-up cellular tissue. This is the appearance of a giant-cell sarcoma after hardening of the tissue in formalin or alcohol.

FIG. 28.

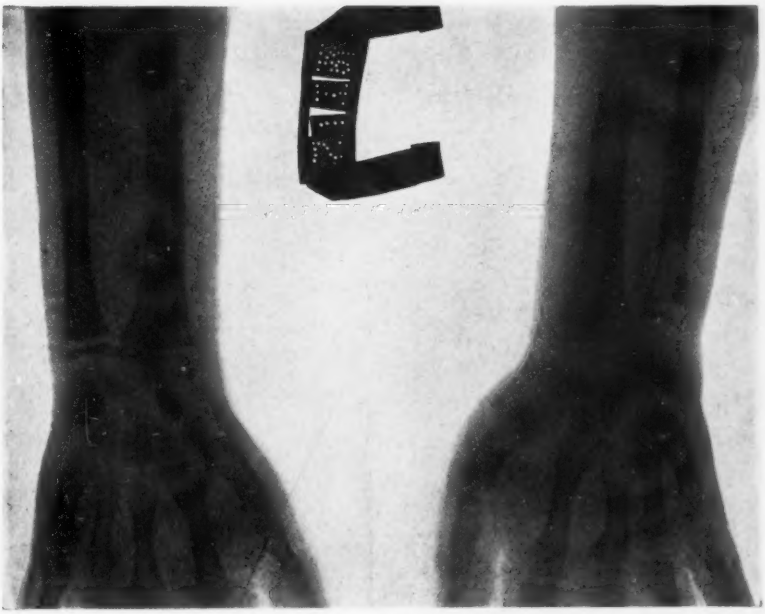


Pathol. No. 4520. Photomicrograph of section of tissue shown in Fig. 27. Typical histologic appearance of a giant-cell sarcoma.

FIG. 29.

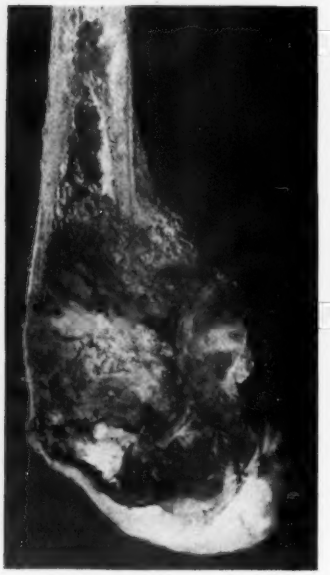
Pathol. No. 6893. Giant-cell sarcoma of lower end of ulna. X-ray before operation. Davis's case.

FIG. 30.



Pathol. No. 6893. X-ray of the result in case shown in Fig. 29 five years and five months after operation.

FIG. 31.

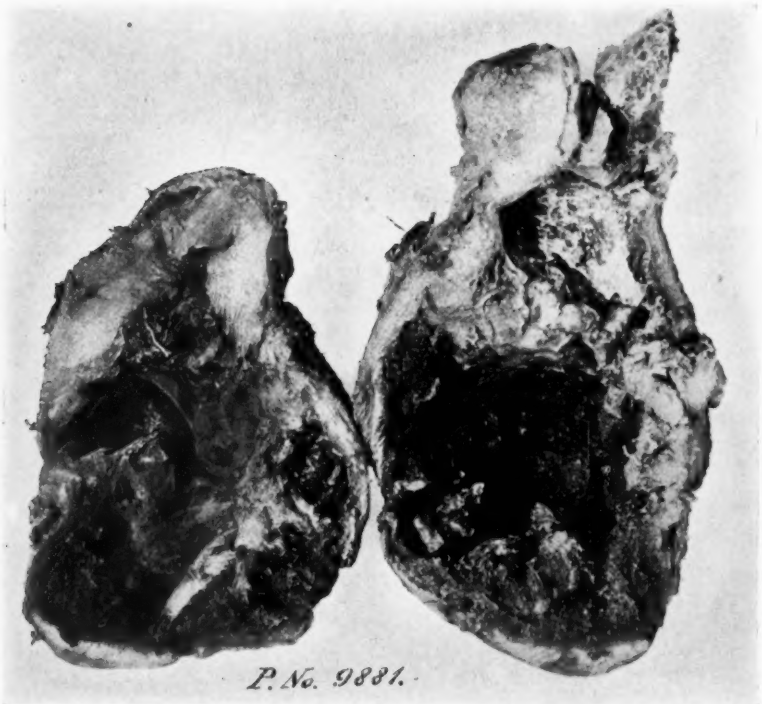


Pathol. No. 7440. Giant-cell sarcoma. Photograph of alcohol specimen. Longitudinal section through femur showing medullary growth. Taylor's case.

FIG. 32.

Pathol. No. 9881. X-ray of a giant-cell sarcoma confined to the medullary cavity of the inner condyle of the femur, before first operation. DaCosta's case. See Fig. 33.

FIG. 33.




Pathol. No. 9881. Photograph of a longitudinal section through the inner condyle of the femur removed by local resection. (See Fig. 32.) Note the central giant-cell sarcoma with cyst formation,—a distinct fibrous and bony capsule and areas of ostitis fibrosa as in Fig. 37.

Goldthwaite in Boston was good enough to send me X-ray pictures of multiple cyst formations in osteomalacia. The pathologic investigation was made by Dunlop. The symptom of onset was coxa vara. In Hart's case there were giant-cell tumors similar to those in Hirschberg's case. His patient was seventy-six; the cyst formations were numerous, also the fractures. In 1886 Rindfleisch called attention to cysts in osteomalacia.

The evidence, therefore, of marked cyst formation in osteomalacia is more conclusive than in Paget's disease.

*Cysts in Multiple Enchondromas.*—I have called attention to the relatively few observations of cyst formation in enchondroma—four cases, the first observation by Virchow. In the publication of Froriep (Chirurgische Kupfertafeln, 1831) there are illustrated autopsy findings which can be interpreted as cysts in multiple chondromas. Froriep looked upon them as hydatid cysts. The patient had suffered years with rheumatic pains, and before death there was a spontaneous fracture of the tibia. Virchow looked upon this observation as an example of Von Recklinghausen's disease. Koch mentions that Nélaton had reported a case of multiple cysts which he attributed to the liquefaction of primary solid cartilage tumors.

Single and multiple central enchondromas are rare, but undoubted examples have been reported. I have just had the opportunity to see with Drs. Le Conte and Longcope in the Pennsylvania Hospital of Philadelphia, a medullary lesion of the entire left femur which, in the X-ray and clinically, suggested ostitis fibrosa, but the tissue removed by Drs. Le Conte and Lee, when studied under the microscope is chiefly cartilage in places undergoing degeneration; here and there are islands of ostitis fibrosa; there are no giant-cell areas. The case, then, differs from my variety 4 (see Fig. 8) in that cartilage composes the principal part of the new formation in the medullary cavity, and ostitis fibrosa is observed only in small areas. This case is apparently unique up to the present time.

*Multiple Cysts in Sarcoma.*—The case reported by Westphalen and mentioned by Glimm, it seems to me, resembles Rehn's case of multiple ostitis fibrosa with cysts and giant-cell

tumors. The patient was over forty and came to the clinic complaining of pain in the knee of a few days' duration, but on examination multiple swellings of the bones were found which had been present six years, painful at first only. At the autopsy blood cysts were found in the epiphyses of a number of bones and in the wall of the larger cyst in the tibia he found numerous round cells. It is unfortunate that the autopsy was so incomplete, because it would be very interesting if the diagnosis of Westphalen of cystic degeneration of multiple sarcoma could be supported by better evidence. The one unusual finding was the blood in the cysts which we have observed before in giant-cell sarcoma and especially in the bone aneurism.

Westenhoffer, discussed by Von Haberer, reports a multiple cystic condition of the entire skeleton which he attributes to mercurial poisoning.

These diseases of the entire skeleton should be considered by the surgeon in his differential diagnosis. I have not mentioned multiple myeloma in detail, because so far no cyst formation has been observed in this disease, and, as I have stated before, the diagnosis is best made by an examination of the urine.

### GIANT-CELL SARCOMA.

There are two remarkable facts in my list of eighteen personally studied cases of medullary giant-cell sarcoma: first, every one of the cases is well to-day; second, of the eighteen cases ten—over 50 per cent.—were situated in the lower end of the radius. In my list of all sarcomas of bone the radius (all in the lower end) has never been the seat of any other tumor except this giant-cell sarcoma.

#### *Cases Which Have Been Subjected to Curetting.*

CASE I.—Pathol. No. 4520, tumor in upper end of tibia; patient aged twenty-nine, symptoms nine years after trauma. Operation (Bloodgood) December 4, 1902: April, 1910, well seven years and five months. This case has been reported by me in the *Johns Hopkins Hospital Bulletin,* vol. xiv, May, 1903. (Figs. 24, 25, 26, 27, and 28.)

CASE II.—No. 6893, tumor in lower end of ulna; patient aged two and one-half years; symptoms nine months. Operation by Dr. G. G. Davis, of Philadelphia, December, 1904. April, 1910, well, five years and five months. This case has been reported by Davis in the *University of Pennsylvania Bulletin*, November, 1905, vol. xviii, p. 249. Dr. Davis in this paper gives credit to my publication in 1903 for suggesting to him the conservative operation, and my result which was known at that time seemed to justify it.

Through the courtesy of Dr. Davis and the kindness of the patient's father, who is a physician, I am able to reproduce the original X-ray made before operation (Fig. 29) and one of the results (Fig. 30) to-day, from which it is impossible to conclude that there had been any previous disease.

The description made by Davis of his operative findings describes graphically the typical picture of a giant-cell sarcoma containing a cyst. Davis writes: "An incision . . . revealed a thin shell of bone which on being removed exposed a cavity filled with 5 c.c. of thin dark-brown fluid; the cavity extended upwards, gradually diminishing in size until it ended half-way up to the elbow; it had a couple of ridges in it and laid near the surface; the cavity in its lower spherical part contained only brown fluid and no lining membrane; the upper conical portion was filled with a reddish granulation-looking material, soft in consistency, with no trace of any cartilage. The tissue was removed, and the cavity thoroughly curetted and packed with gauze. . . . The microscopic examination showed the growth to be a round-cell(?) sarcoma with numerous giant-cells."

The question which arises here is: can this case of Davis be looked upon as a benign bone cyst with ostitis fibrosa and giant-cell areas, or is it a true medullary giant-cell sarcoma with cyst formation (Fig. 38)? It differs from the other bone cysts which I have personally observed, and apparently from those in the literature. The cysts in giant-cell sarcoma which I have previously noted (p. 151) as variety 9 of Group B, apparently, from the meagre details given, resemble this case of Davis. I wish to emphasize here that in this medullary lesion which has remained well now over six years after

curetting, the fluid contents was not hemorrhagic, as observed in my three cases of bone aneurism. In this observation of Davis's apparently all the solid tissue resembles, in the gross and microscopic, the giant-cell sarcoma. Nothing suggestive of ostitis fibrosa was found, but as sections of the bony shell were not made, this cannot be excluded. I mention this fact here, because in some of my cases of giant-cell sarcoma I have demonstrated large areas of ostitis fibrosa.

CASE III.—Pathol. No. 7440, tumor in the lower end of the femur in a white male, aged twenty-two, symptoms of five months' duration, probably after trauma. January 26, 1906, Dr. Wm. J. Taylor, of Philadelphia, curetted; there was local recurrence in a few months and amputation was performed by Dr. Taylor. This patient at the present time—four years and three months since the first operation—is well.

This case is interesting, because the symptom of onset first observed by the young athlete who was a tennis player, was weakness of the left knee; pain and discomfort followed; swelling was late. Dr. Taylor notes that the general condition of the patient suggested anæmia, but there was no blood count. The X-ray was pretty typical of a medullary tumor preserving a bony shell. It is interesting to observe that a few days before operation, and while at the hospital, the patient had some fever. Dr. Taylor writes me as follows with regard to the operation:

"On cutting down to the bone it was found to be soft, and the knife readily entered a cavity which involved the whole of the lower end of the femur; a large quantity of soft, broken-down and unhealthy tissue was scraped out with the curette. . . The cavity thus cleaned out was large, and my finger-tip could sweep around the whole of the wall, which seemed to be smooth and unbroken at any point. The bleeding was profuse, so much so that it was necessary to pack firmly. . . . . There was tremendous oozing of blood for days, and all the packing was not taken out for a long time. Gradually the cavity filled with granulation tissue and finally closed."

I wish to call attention to this description by Dr. Taylor of the diffuse bleeding when a medullary giant-cell sarcoma is curetted, and I should advise the routine employment of the

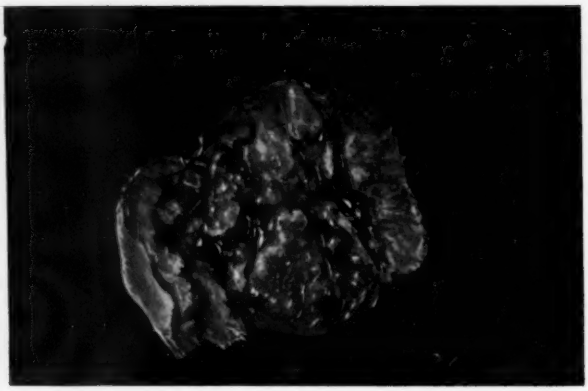
FIG. 34.

Pathol. No. 10376. X-ray of medullary giant-cell sarcoma of lower end of radius. Chambers's case.

FIG. 35.

Pathol. No. 8412. X-ray after operation in Bloodgood's case, resection of a recurrent tumor in the lower end of the radius. Transplantation of piece of ulna to radial defect.

FIG. 36.



Pathol No. 8412. Painting of fresh appearance of giant-cell sarcoma (Bloodgood's case), recurrent in the lower end of the radius.

FIG. 37.

Pathol. No. 8680. Giant-cell sarcoma of lower end of radius of at least six years' duration. Photograph of section of fresh specimen showing the definite fibrous capsule; the bony shell has almost disappeared. The red, currant-jelly areas (*g*), the definite white areas of ostitis fibrosa (*f*), and the mottled red and white areas of the mixed giant-cell tumor and ostitis fibrosa (*gg*).

FIG. 38.

Pathol. No. 7851. Medullary giant-cell sarcoma of lower end of femur. Photograph of section through femur and tibia. Interesting on account of the cyst formation in a typical giant-cell sarcoma. Patient of Dr. Mitchell of Washington. Well two and one-half years since amputation.

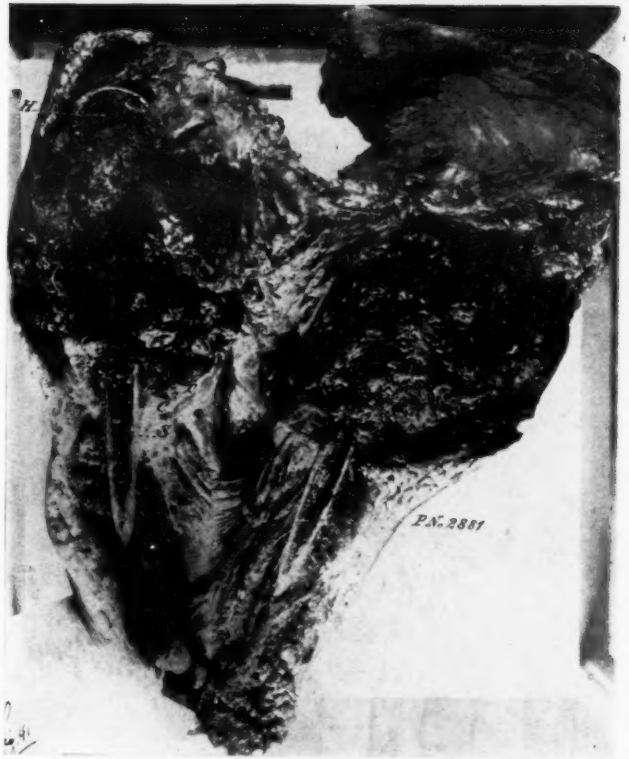
FIG. 39.

Pathol. No. 6471. Bone aneurism. Blood cyst at lower end of tibia. Spindle-cell sarcoma in wall of cyst. Mistaken at first operation for benign bone cyst. Death one year later of metastasis. Finney case.

FIG. 40.

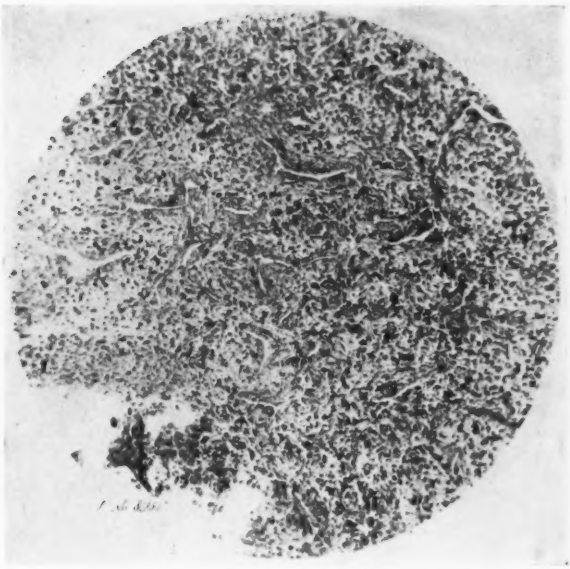
Pathol. No. 2881. Huge bone aneurism of upper end of humerus. Age, 32; p in, four years; rapid swelling after trauma, six months. Amputation. Death in two and one-half years of metastasis.

FIG. 41.



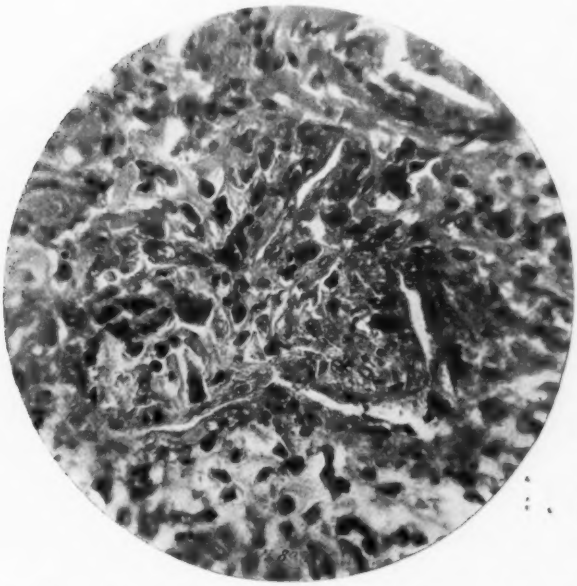

Pathol. No. 2881. Specimen obtained by amputation from patient shown in Fig. 40. *H*, remains of head of humerus; *S*, remains of shaft; *C*, wall of cavity between *S* and *H* filled with blood-clot and lined by a narrow zone of thin tissue (spindle-cell sarcoma).

FIG. 42.



Pathol. No. 8951. Photomicrograph of wall of a bone aneurism in the lower end of the femur. See text, Case III.

FIG. 43.



Pathol. No. 8951. High power photomicrograph of Fig. 42. Round- and spindle-cell sarcoma with a few giant-cells.

Esmarch, which, I am quite certain, allows a more thorough curetting, and after this a disinfection of the cavity with pure carbolic acid, followed by alcohol and later by boiling water, as recommended by Von Eiselsberg, and even the use of the Paquelin cautery. If one is able to compare my case in the upper end of the tibia with Dr. Taylor's in the lower end of the femur, there seems no reason why he did not obtain an equally good result; there was, however, some difference in the technic: I employed the Esmarch and am quite confident that thanks to this I was able to curette more thoroughly; then the cavity was disinfected with pure carbolic acid a number of times; when the Esmarch was removed the bleeding was so profuse from the bone shell that I replaced the Esmarch and lined the cavity with wax; I then packed gauze into the cavity with a hammer and chisel; there was no bleeding when the Esmarch was removed.

The danger of hemorrhage in curetting a giant-cell sarcoma, especially in the large bones, should be borne in mind, and before proceeding with the operation one should be prepared to deal with this complication promptly.

I have been able to study the tissues removed by Dr. Taylor at the first operation with the curette and through his courtesy I have the specimen obtained by amputation (Fig. 31). This case is interesting, because it is one of my examples in which in a giant-cell sarcoma there are areas of ostitis fibrosa. I am sorry that Dr. Taylor could not see his way clear to attempt a second curetting. I will bring forth evidence that in giant-cell sarcoma repeated curetting has not shown any danger of metastasis, and now and then has accomplished a cure after two or more trials.

Case IV.—Pathol. No. 9881, tumor of lower end of femur (Fig. 32). The tumor was removed by the curette in March, 1909, by Dr. J. C. DaCosta, of Philadelphia. It was confined entirely to the inner condyle of the lower end of the femur. There was recurrence, and in June, 1909, I was given the opportunity by Dr. DaCosta to study the sections of the tumor and the X-ray of both the primary and the recurrent medullary tumor.

The X-ray showed that the recurrent tumor occupied exactly the same circumscribed area in the inner condyle as the primary tumor. The microscopic appearance was that of a giant-cell sarcoma. July 10, 1909, through the courtesy of Dr. Da Costa, I had the opportunity to explore this tumor in the Jefferson Hospital and to remove it by local resection, preserving the outer condyle and the continuity of the shaft of the femur. The tumor was absolutely circumscribed, as shown in the X-ray and in the photograph of the specimen (Fig. 33). At the present time, April, 1910, about nine months since operation, there is no evidence of recurrence.

It should be noted that in both Dr. Taylor's and Dr. Da Costa's cases the recurrence took place in a few months. I have not been able as yet to study all the cases in the literature, and for this reason cannot speak with any degree of certainty, but it is my opinion that if recurrence takes place it will do so in a few months.

CASE V.—Pathol. No. 10376, tumor in the lower end of the radius. Female, aged twenty-five, symptoms five months after trauma. Curetting April 19, 1908, by Dr. Chambers, of Baltimore. Recurrence, second curetting a few months later. This patient is apparently well to-day (April, 1910) two years since the first operation, and has a most useful arm. Through the kindness of Drs. Chambers and Cotton I have been able to study the X-rays (Fig. 34) and tissues in this case. It is a giant-cell sarcoma.

Of the ten cases of giant-cell sarcoma of the lower end of the radius of which I have complete notes, four were subjected to amputation, four to resection, one to curetting and one patient has been lost track of after refusing amputation. If the X-rays of this case, cured up to the present time by curetting, are compared with the other cases, one, I am sure, will feel inclined to curette at least as a first attempt before resorting even to resection. The resection of the lower end of the radius without a substitution of bone does not give a hand with very good function, and, as stated before, it is my opinion,

based upon considerable evidence, that in giant-cell sarcoma one should first if possible curette, because there is apparently no risk of metastasis by such an operation.

*Cases Which Have Recurred, After Partial Operation, and Which at the Present Time Show no Evidence of Metastasis.*

CASE I.—Pathol. No. 1815, tumor of lower end of radius. Partial curetting a few months before amputation. This patient is well (April, 1910) fourteen years since the operation. In this case, I am informed, the curetting was done without an Esmarch. In the cases of Taylor, DaCosta, and Chambers the curetting was followed by recurrence without any deleterious results.

In one of my own observations there were three operations on the tumor of the lower end of the radius before the patient came under my care. The history is as follows:

Pathol. No. 8412. White male, aged twenty-nine. A swelling was observed in the lower end of the radius twenty months after a trauma. There have been three operations, one when the swelling had been present four months, sixteen months ago; the second one a year ago; these two operations consisted of incision and curetting; at the third operation the lower end of the radius was resected. As far as I can make out none of the operations can be considered complete. The recurrent tumor occupied the defect between the carpus and the resected end of the radius; it was distinctly encapsulated, and could be dissected free without injury to the tendons. I felt that its removal was just as complete as if amputation had been done. To improve the function of the hand I transplanted a piece of ulna to the lower end of the radius, so that the two bones were of even length (Fig. 35). At the present time (April, 1910), almost three years since operation, the patient is well and there is very fair function.

The evidence, therefore, should justify one to attempt the removal of a giant-cell sarcoma of the medullary cavity with the curette, but the technic of curetting should consist of the application of the Esmarch and the thorough disinfection of the bone cavity.

In my list of eighteen cases the curetting has been attempted seriously in five; three of these have remained well: my own in the upper end of the tibia, Davis's case in the lower end of the ulna, and Chambers's case in the lower end of the radius. Two cases have recurred: patients of Drs. Taylor and Da Costa, but these patients are apparently well: one after amputation of the femur and one after resection of the inner condyle of the femur. In two cases the curetting, which was done before the patient came under observation, cannot be looked upon as more than an exploratory incision.

*Cases from the Literature in Which Curetting Was Done.*

Up to the present time my study of the literature is not complete, and it would be impossible to delay this paper for its completion. It is interesting to note, however, that up to the present time we have collected nineteen cases of undoubted giant-cell sarcomas among which six were curetted: in one only did the tumor recur and the patient remained well since local excision. The cases are as follows:

O. Kocher: Left tibia, well three years. Age 26, symptoms 2 years and 3 months.

Kramer: Lower end of femur, well twelve years. Age 16, symptoms 6 months.

Kramer: Upper end of humerus, well eight years. Age 13, symptoms nine months.

Karewski: Shaft of femur, well four years. Age of patient and duration of tumor not stated.

Kopfstein: Fibula, well two years and four months. Age 8, symptoms ten months. In this case there was recurrence four months after curetting, and the tumor was then excised.

Hinds: Lower third of femur, well two years and six months. Age 34, symptoms fifteen months.

These results are therefore somewhat better than among the cases I observed. Kocher's successful case somewhat resembles mine in its position in the tibia, although in his case the tumor was situated in the lower end of the tibia. It is very important to note that in three of the five successfully curetted cases the tumor was in the femur, two in the lower end and one in the shaft. I emphasize this, because from the experience

of Drs. Taylor and Da Costa one might be unwilling to attempt curetting here.

Of the remaining thirteen cases all of the patients have remained well, a number of them longer than four years since operation. The relative frequency of giant-cell sarcoma in the lower end of the radius in this group is less than in mine: three instead of ten. But it must be borne in mind that this list from the literature is by no means complete.

The following cases have been found in the literature and are noted here, because the tumors were curetted: some of these may be giant-cell sarcomas.

Wiesinger. Femur, upper third; patient aged fifty years; tumor a myxochondrosarcoma. Recurrence in three months, amputation. Well six years.

Kocher: Right tibia. Recurrence one month after curetting, amputation. Well twenty years. The patient's age was forty-eight, symptoms two years. Kocher simply says it is a myelogenous sarcoma.

Jenckel: Upper third of femur, in trochanter minor. Well twelve and one-half years. Age twenty-two, symptoms four and one-half months. Jenckel describes a bony shell containing a blood-cyst. This suggests a tumor similar to that in Davis's case in the lower end of the ulna.

The evidence, therefore, in the literature favors the position taken in this paper that curetting in selected cases is justifiable.

*The Diagnosis of Giant-cell Sarcoma.*—The age of the patient in my list with one exception has varied between twenty and sixty-six at the onset of the symptoms. The patient of Davis was two and one-half years of age. This is a very interesting fact. I have previously stated that the age of onset of the medullary benign cyst or ostitis fibrosa is rarely over twenty; now we find that the medullary lesion which casts a somewhat similar shadow in the X-ray is rarely observed under twenty and may arise as late as sixty-six. It is fortunate, therefore, that throughout life we may expect this benign, or rather less malignant, medullary disease, and it is this fact that makes it imperative to explore every medullary tumor seen in the X-ray or exhibiting itself clinically with swelling or pathologic fracture, before resorting to amputation.

In the literature there are a few cases of medullary giant-cell sarcoma under twenty years of age—enough to show that the giant-cell sarcoma is much less infrequent in patients under twenty years than the bone cysts in patients over twenty.

*The duration of the tumor* in giant-cell sarcoma has varied from five weeks to nine years, both in my cases and in those noted in the literature. In quite a number of cases the bony shell has been perfectly preserved after the symptoms had been observed a number of years; in my case nine years. When the symptoms have been present over two years the more malignant medullary sarcomas can practically be excluded.

In my table of cases trauma has been an etiological factor in every case, in a few there has been a definite fracture (two of the medullary giant-cell sarcomas of the lower end of the radius were associated with Colles's fractures). Pain is not a very prominent symptom, but it is practically always present, and there is tenderness; expansion of bone takes place sometimes a number of months after the local pain and tenderness. As a rule the expansion is slow. In contrast to the cysts in ostitis fibrosa, on one hand, and the more malignant medullary sarcomas, on the other, pathologic fracture in my experience has not been observed in giant-cell sarcoma. The X-ray shadow does not differ at all from that of a bone cyst (Figs. 24 and 29). It is true, that as a rule in a giant-cell sarcoma the distention of the bone is more abrupt and circumscribed (Figs. 32 and 34). That is, the involvement of the medullary cavity in the longitudinal diameter of the bone is much more limited than in bone cysts (Figs. 1, 2, 4), but the distention of the part involved is greater. Both in bone cysts and in giant-cell sarcoma, we may have great distention of the marrow cavity with the preservation of the bony shell, while in the more malignant medullary sarcomas the tumor as a rule grows directly through the bone without producing much distention. In multiple myeloma the shadow does not differ in the early stage from bone cysts or giant-cell sarcoma. In my experience, in the fully developed bone cyst or giant-cell sarcoma, one would be able to exclude with considerable certainty any

other medullary lesion, except the myeloma when occurring as a single lesion, but I can imagine that in the very early stage of the more malignant medullary sarcoma the shadow could not be differentiated from that of the cyst or giant-cell sarcoma. For this reason the ultimate diagnosis must rest until the exploratory incision is made.

I wish to emphasize this difficulty in the X-ray plate. My more recent experience has demonstrated that as we see bone lesions, both medullary and periosteal, earlier we find positive differential diagnosis from the X-ray more and more difficult.

Again, giant-cell sarcoma in a few instances may break through its distended bony shell and produce a periosteal tumor, infiltrating the soft parts. In a case situated in the lower end of the radius of but three months' duration the bone capsule was destroyed and the joint and soft parts infiltrated. In this case there had been repeated traumatism. The patient, however, has remained well twelve years after amputation. In this case, I am inclined to think, the infiltration of the soft parts was too extensive for an attempt even at resection. Clinically and in the X-ray this case had the characteristic features of the most malignant type, yet in the gross it was recognized as the hemorrhagic giant-cell tumor, and this was confirmed by the microscope. In a second case in which the tumor was situated in the lower end of the radius, it would be impossible to make out a bony shell in the X-ray, and the operation revealed infiltration of the soft parts, yet the tumor was a giant-cell sarcoma, and the patient has remained well ten years since amputation.

The medullary giant-cell sarcoma may now and then exhibit the features supposed to be characteristic of the more malignant types.

There is evidence that infiltration of the soft parts outside the bone capsule in medullary giant-cell sarcoma need not be looked upon as positive indication for amputation. Resection is justifiable, provided after the removal of the disease a limb with useful function will be preserved. In 1892 Dr. Halsted resected the lower ends of radius and ulna for a pulsating

periosteal tumor surrounding the ulna. The patient was a colored woman aged forty-five and the tumor had been present one year. It is the only giant-cell sarcoma in which pulsation has been noted. At the operation the tumor had the characteristic appearance of the giant-cell neoplasm. In the tissues removed I have demonstrated with the microscope that the zone of uninvolved muscle removed beyond the tumor was so narrow that it all can be seen in one field under the low power of the microscope. Yet this patient remained well twelve years since the operation, and died of other causes. The function of the arm was fair.

The local growth of giant-cell sarcoma is usually circumscribed, even when it is periosteal, but now and then a certain degree of infiltration is noted.

*The Fresh Appearance of Medullary Giant-Cell Sarcoma.*—I have now seen giant-cell sarcoma in the medullary cavity of the long pipe bones about twelve times, and in addition I have observed it in the fresh twice in the medullary cavity of the lower jaw, and, perhaps, as a periosteal epulis ten or fifteen times. In all the other cases I have observed the tissue only after hardening in alcohol or formalin. I have been struck by the uniformity of its fresh appearance (Fig. 36). It differs from the periosteal and medullary sarcoma of the spindle-, round-, or mixed-cell type by its color. It is distinctly vascular; it resembles to a certain extent young granulation tissue. The appearance can be well described as that of currant-jelly, and I find this term employed by many others in the literature. Mixed with the red areas there may be white areas, and areas mottled, white and red (Fig. 37). The second characteristic feature is the consistency of the tumor. There seems to be a complete absence of any supporting stroma. It can be broken up with the finger or the curette into small pieces (Fig. 27), and one sees not even the finest connective tissue holding the pieces together, yet it does not break up into finely granular masses characteristic of the very cellular round-cell sarcoma. The consistency resembles to a certain extent " Schmierkaes." In a few instances the white areas are quite firm and fibrous, then we have an admixture of ostitis fibrosa.

It is very remarkable that this vascular, cellular tumor is in its growth just as circumscribed as a fibro-spindle-cell fibroma or fibrosarcoma. The giant-cell sarcoma tissue can be removed from its bony shell as easily as the connective-tissue lining of a bone cyst, in fact it is less infiltrating than the fibrous tissue of the latter. In many cases the giant-cell tumor cannot be demonstrated deep in the bony capsule.

Microscopically (Fig. 28), giant-cells somewhat of the osteoclast type predominate in the picture. Without these giant cells the histologic structure suggests granulation tissue: there are numerous endothelium-lined blood spaces separated by connective-tissue stroma filled with spindle and round cells, but here we find very little of the eosin-staining fibrous tissue and very few fibroblasts; the giant cells are often seen in the endothelium-lined space, and some investigators have looked upon the giant cells as the product of endothelial budding.

### BONE ANEURISMS.

I have observed three cases of bone aneurism—a term employed in the literature to describe a hæmatoma in a very malignant medullary spindle- and round-cell sarcoma. In only one of these cases was there any difficulty in making the differential diagnosis. I will describe this case first,—as it has many unusual features.

Case I.—Pathol. Nos. 6326 and 6471. Bone aneurism in lower end of tibia. Male, aged thirty-five. This patient for twenty-five years, since ten years of age, has had pain and swelling in the region of the left ankle. At the onset, on account of the pain, he was confined to bed fourteen months. Since then the swelling has remained and he would only have recurrent attacks of pain. The condition has been diagnosed arthritis. Six weeks before operation, on account of the recurrence of the pain, he consulted Dr. Hamburger, who referred the patient to Dr. Finney. The swelling and pain were confined to the lower end of the tibia. An X-ray was taken and the shadow was looked upon as indicating a bone cyst. At the operation the cavity contained blood clot and was lined by tissue resembling organized blood clot. Curetting was done. The tissue which I received in the labora-

tory consisted chiefly of blood clot and organized blood clot. From the sections it was very difficult to make a positive diagnosis. There were hemorrhage, granulation tissue from the organization of the blood clot and a tissue very rich in spindle and round cells in which there were a number of giant cells.

The first operation was performed April 28, 1905. The cavity filled so rapidly with a hemorrhagic tissue that one could feel quite certain that it was not a benign cyst, and even a giant-cell sarcoma, from our present-day experience, could be excluded from this very rapid growth filling the cavity. I saw the patient with Dr. Finney at the second operation June 14, 1905. The tissue of the medullary tumor had now broken through the bone in places and infiltrated the soft parts. The growth was pearly-white in color and coarsely granular—not at all the appearance of giant-cell sarcoma, but that of a spindle-cell sarcoma. In the centre of the cavity was organized blood clot. As the tumor had infiltrated beyond the hope of local excision, amputation was performed. The patient died about one year after the second operation with evidence of internal metastasis.

When we examine critically the specimen (Fig. 39) we find that there is not a distinct shell as seen in bone cysts or giant-cell sarcoma, but a cortical bone varying in thickness, irregularly eroded by the infiltrating tumor which in places has perforated it. When we examine the sections we can understand the difficulty of diagnosis from the tissue removed at the first operation, because the organized blod-clot tissue covering the surface of the tumor has, in places, no evidence of the tumor at all: it shows organized blood clot containing a few giant-cells, while the tumor itself is a pure spindle-cell sarcoma without giant cells. That is, at the first operation we examined the hemorrhagic contents and little or nothing of the tumor proper.

CASE II.—Pathol. No. 2881. Bone aneurism in the upper end of the femur. The clinical picture was looked upon as so characteristic of a malignant sarcoma and so extensive that a shoulder-girdle amputation was done by Dr. Cushing without exploratory incision. The patient lived four years and died with evidence of local recurrence and internal metastasis, the symptoms of which had been present four months before death. The patient was a male, aged thirty-two, and had suffered pain in the region of the right shoulder four years; the pain was

worse after a hard day's work, yet there was no weakness or swelling. Six months before operation, after a contusion of the shoulder, there was very rapid swelling with the formation of the tumor shown in Fig. 40. The specimen (Fig. 41) exhibited a huge cavity filled with blood clot, with complete destruction of the bone. A piece of the head (*h*) is preserved and the shaft (*s*) ends abruptly in the hæmatoma. This cavity has a thin connective-tissue capsule (*c*). Only under the microscope was I able to make out a thin zone of tumor tissue—a spindle-cell sarcoma.

CASE III.—Pathol. No. 8951. Bone aneurism in the lower end of femur. White male, aged twenty-one. Sustained a traumatism to the knee four months ago, followed by swelling on the inner side, severe pain and stiffness of the knee. Six months before operation the exploratory incision was made, and there has been a discharge of blood from sinus since. The cavity was explored by Dr. Finney, who found a huge hæmatoma. In the tissue removed with the curette I demonstrated with the microscope only the presence of round-cell sarcoma (Figs. 42 and 43). As the condition was looked upon as incurable, the patient was allowed to go home. I am informed that he died a few months later of metastasis.

With our experience with bone cysts, ostitis fibrosa and giant-cell sarcoma I am of the opinion that the bone aneurism, if seen in the early stage as in my first case, can be recognized by the hemorrhagic contents which is never present in bone cysts and, so far in my experience, is very rare in giant-cell sarcoma. When present in giant-cell sarcoma, the cyst is a relatively small affair and the characteristic giant-cell tissue is present in large quantities about the cyst. [See Davis's case (Fig. 29) and Mitchell's case (Fig. 38)].

These three personally observed cases have in common a cavity filled with clotted blood. In two cases the bony shell had been partially or completely destroyed; in one, that situated in the lower end of the tibia, the bony shell at the first operation was apparently preserved, but at the second operation the tumor tissue had infiltrated through bone shell into the surrounding tendons and muscle. In not one of these three cases

was there a sufficient wall of tumor tissue to recognize it at the exploratory incision.

As compared with the benign bone cysts these hæmatomas in the medullary cavity can be distinguished by the contents of the cavity. In the benign bone cyst the contents is never so hemorrhagic.

Although giant-cell sarcomas are very vascular, cysts, especially hemorrhagic cysts, must be very unusual. The cyst in Davis's case, in the lower end of the ulna, had an appearance not at all suggestive of a bone aneurism, but was rather more like the benign bone cyst. In Mitchell's case (Fig. 38) the cyst is but a small part of the giant-cell sarcoma of the lower end of the femur. In my personally studied cases of giant-cell sarcoma I have not observed anything at all like these three cases of hæmatoma in medullary spindle- or round-cell sarcoma. For this reason I have turned to the literature for aid. In Group 9, cysts in giant-cell sarcoma, which have gotten into the literature among the benign bone cysts, there is not sufficient detail to give the exact contents of the cyst. Apparently the bony shell was preserved, the cyst was but a small affair in the centre of a giant-cell tumor, and there was nothing in these cases to suggest a bone aneurism.

But medullary sarcoma may present itself with a clinical picture suggestive of what might be called a bone aneurism. There have been three cases sent to surgical pathological laboratory, two of these from Dr. Halsted's clinic. That is, among thirteen medullary spindle- and round-cell sarcomas three have been the seat of central hæmatomas.

Nakayama (*Beiträge z. klin. Chir.*, 1909, lxiv, 524), in 1909, reports three cases from Garré's clinic in Bonn, and adds some new cases to those already collected by Gaylord (ANNALS OF SURGERY, vol. xxxvii, 1903, 834).

It is very difficult to classify these cases, many of which are from the older literature and without pathological study. They all seem to have one feature in common—a central hæmatoma. In every properly studied case there has been a wall of tumor tissue, in a few cases giant-cell sarcoma, in the

majority the more malignant spindle- and round-cell sarcoma.

In some of the cases, clinically, there was pulsation, a few of these exhibited a bruit. In some of the older cases the injection of the larger artery demonstrated an arterial communication with the cavity in the bone. This is not unusual and should by no means be interpreted as an aneurism. In my observation of giant-cell sarcoma of the tibia, after curetting the tumor and removing the Esmarch one could see large vascular spaces in the bone, undoubtedly vessels. Taylor in curetting his giant-cell sarcoma of the femur comments upon the hemorrhage, and in three cases of the very large bone cysts hemorrhage was a marked feature. I have observed a periosteal giant-cell sarcoma of the ulna to pulsate, and am surprised that pulsation has not been noted in more cases of medullary giant-cell sarcoma. Up to the present time pulsation or bruit in a medullary bone tumor can be looked upon as a clinical sign excluding a benign bone cyst or ostitis fibrosa, but not the relatively benign medullary giant-cell sarcoma. The absence of a bone shell in places or almost entirely does not absolutely exclude medullary giant-cell sarcoma, but is suggestive of this more malignant medullary tumor with a central hæmatoma.

Nakayama's first case corresponds exactly with my Case III (Pathol. No. 8951). The patient was a male aged thirty-one, pain and swelling eight months; considerable expansion of the lower third of the femur, in places absence of the bony shell with fluctuation, but no pulsation or bruit; definite infiltration of the soft parts; at the exploratory incision a thin bony capsule, a wall 2 to 3 mm. in thickness, a huge hæmatoma; first diagnosis—giant-cell sarcoma; after amputation and more complete study this case was changed to spindle- and round-cell sarcoma. There was the usual result—death from local recurrence and metastasis.

Now, these two cases of bone aneurism or hæmatoma of the lower end of the femur could be differentiated from any case of bone cyst or giant-cell sarcoma that I have studied in this position.

Nakayama's second case resembles my second case (Pathol. No. 2881) in its position in the upper end of the humerus. At the exploratory incision there was a thin bony shell which

in places was destroyed and a cavity filled with blood clot and tumor masses; the muscles were infiltrated; microscopically, it was a round-cell sarcoma. The patient was a male aged eighteen, and the pain in the shoulder had been present two years, the swelling one year.

Nakayama's third case, from his description, might suggest a similarity with a benign bone cyst having a definite connective-tissue lining. As he is quite familiar with the literature on bone cysts and ostitis fibrosa, and as a careful microscopic study was made of the connective-tissue lining with the report of a spindle-cell sarcoma, one has no right to be skeptical. The case is unusual, because the patient was but four years of age. In my experience the malignant medullary tumors are very rare at this age, while the benign bone cysts are common. From his description of the X-ray there was apparently a pretty typical thin shell of expanded bone. The only difference from a benign bone cyst was found at the exploratory incision: the cyst contained dark blood under pressure and blood clot. In addition, there were areas in which the bone shell had completely disappeared. This is very unusual in the benign bone cysts of small size. That a microscopic study of the blood-clot débris may give rise to the diagnosis of giant-cell sarcoma is emphasized in this case, because giant cells were found in the hemorrhagic débris; the spindle-cell sarcoma only in the connective-tissue wall. In my first case and in Nakayama's first case a diagnosis of giant-cell sarcoma was tentatively made from the tissues removed at the first exploration.

In the literature there are numerous cases resembling those reported by Nakayama, Gaylord and my three observations, that is, hæmatomas in the more malignant spindle- and round-cell sarcomas. But among these cases collected by Gaylord and Nakayama, there are some that do not belong to this type. Roughton's case reported in 1890 answers every description of a benign bone cyst in a child of four, a cyst in the upper end of the tibia. To confirm this the child was well at the report three years after a partial curetting. Borst,

Luecke, and perhaps Schleich report examples of hæmatoma in giant-cell sarcomas. Luecke's case is very suggestive, because he describes the tumor as soft and red in color (this is giant-cell sarcoma) and with a cavity filled with blood. This patient was living three and one-half years after amputation. Borst's observation is interesting, because in the same individual there was a cyst in a giant-cell sarcoma situated in the lower end of the femur and one in the upper end of the tibia; no further details are given.

Hæmatoma of the so-called bone aneurism type are rare in giant-cell sarcoma.

Wythe's case resembles the cysts in periosteal hæmatoma with an osseous wall (Group B, variety 9), and is not a bone aneurism in the sense of a hæmatoma in a malignant tumor. These blood cysts in subperiosteal hæmatoma with an ossified wall resemble the blood cysts in ossifying myositis and are probably of the same type. It seems to me Oehler's case reported as a bone aneurism belongs to this group.

As I have not considered periosteal tumors in this paper I shall not go into details, but it is interesting to note that we have two benign extra-osseous hæmatomas which must be recognized from malignant disease presenting itself as a hæmatoma.

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# NEOPLASMS AND OTHER TUMORS INVOLVING THE MAXILLARY BONES.

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INTRODUCTORY to the presentation of the subject of tumors of the alveolar process, it might be well to call attention to the unsystematic method in which the subject has been studied.

Bland-Sutton's classification of tooth tumors which was given to us many years ago has not been improved upon so far as embryological tumors are concerned. The consideration of the tumors of the bones entering into the formation of the face has been pretty well presented by the writer during the past. This, however, is not the case regarding tumefactions developing from the soft tissues overlying the alveolar processes.

The classification used here I think will make it much clearer for the student of oral surgery to grasp the differential points between connective-tissue and epithelial tumors. It will be observed that enlargements of the alveolar process that are inflammatory or infective in that they depend upon micro-organisms as a cause have not been considered, and that only the hypertrophies or cystic conditions associated with the teeth are included in this paper.

This subject is best presented by observing the following arrangement:

*A*. Neoplasms of the soft tissues over the alveolar process.
*B*. Chloroma.
*C*. Bone tumors and cysts.
*D*. Malignant tumors.

## *A*. NEOPLASMS OF THE ALVEOLAR SOFT TISSUES.

Independent of odontomata and osteomata other neoplasms are found to develop from the soft tissues.

The most common forms are the following: (*a*) papilloma; (*b*) polypus; (*c*) hypertrophy; (*d*) fibroid and myeloid epulis.

a. *Papillomata.*—Several forms of growth develop from the gums and occur as elongated papillæ in the form of little tufts. Their centre is composed of mesoblastic tissue and they have a covering of the thickened epithelium. They are of the epithelial type. They have an irregular surface with a strawberry appearance. These tufts develop from the gingival margin about one or many of the teeth. The cause is some mechanical irritant as tartar, etc.

A typical case was that of a pregnant woman, aged twenty years, upon whom a radical operation was not advisable. The granulations were strawberry red and irregular, and bled freely upon the least irritation. At several points they grew as high as the crowns of the teeth and more than two-thirds of the teeth were included in the area of growth. Tartar was found throughout the lingual surfaces of the teeth.

*Treatment.*—This consisted in curetting the granulations back to the healthy mucous membrane. The hemorrhage was controlled with adrenalin solution. Tincture of iodine was applied to the wounds. The patient was seen twice every week for four or five weeks when all tendency to return had been controlled and she remained well when seen eight months later.

Fig. 1 illustrates a case of papillomatous growth of the gingival mucous membrane extending entirely around two teeth and including the third along the sides. It was removed by the use of a curette under local anæsthesia and followed by the application of commercial tincture of iodine. There was no return in several months. The surface was strawberry-like and bled under slight pressure.

Fig. 2 shows papillomata of the alveolar process and resembles the case illustrated in Fig. 1, save that its surface was not granular except at some points. Operation included the removal by the use of the knife under local anæsthesia. There was no return after several months.

There is a great tendency to return and even in three or four days they have been seen to grow an eighth of an inch

at points where it was thought they had been thoroughly removed by curettement. Thorough removal, cauterization and disinfection are essential if return is to be prevented. There is no tendency toward malignancy.

Fig. 3 shows a typical polypus of the process in a girl of eight years. The growth was over the alveolus with a distinct pedicle or contracted base attached to the lingual gingival margin. The surface, while slightly roughened, did not bleed as do papillomata. Operation was performed by severing the pedicle with a scalpel under a very mild degree of chloroform anæsthesia. There has been no return.

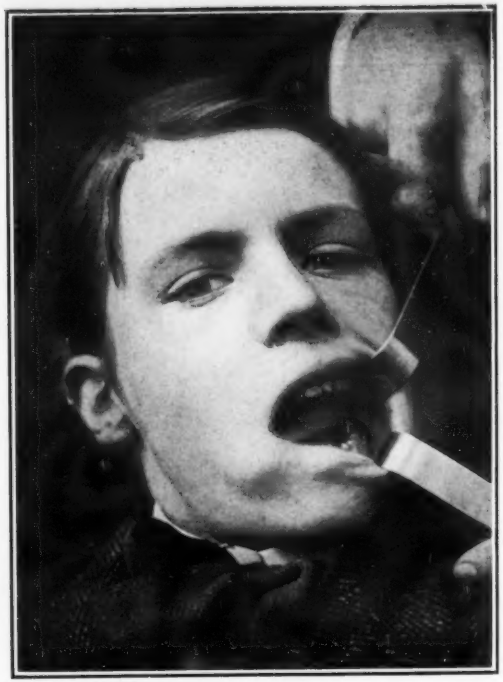
Fig. 4 shows a second case of polypus in a woman aged thirty years. It has been growing for several years. In physical appearance it was the same as in the preceding case. Operation was performed under local anæsthesia. Hemorrhage which was quite severe was controlled by pressure. Repair was prompt and there has been no return.

b. *Polypus.*—Polypi of the gums are seen quite frequently and resemble such growths in other parts of the body. They differ from the preceding in such that they are usually single, grow to considerable size and have a distinct pedicle, while the papillomatous variety is multiple, grows exuberantly and rapidly.

These tumors vary from the size of a pea to a horse-chestnut and are found on the gums in the neighborhood of diseased teeth. They are said to be caused chiefly by the ragged edge of a carious tooth, but it is probable that ptomaines from the operations of bacteria stimulate papillomatous growth upon granulating mucous surface and have more to do with their etiology than is usually supposed. The growths in question are essentially papillomatous, and exhibit on section large, branching papillæ, covered with a thicker layer than normal of squamous epithelium. The polypi are purely local in their origin and are non-malignant.

*Treatment.*—The treatment consists in removal under local or general anæsthetic. A scalpel or scissors may be used. There is no tendency to return. If there is return, the growth

FIG. 1.



Papillomatous growth of the gingival mucous membrane.

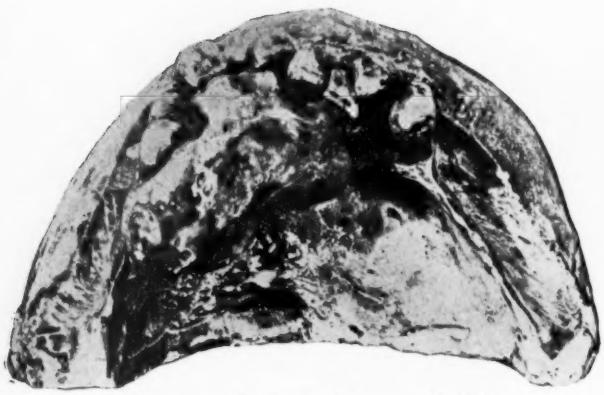
FIG. 2.

Papillomata of the alveolar process, resembling the case illustrated in Fig. 1.

FIG. 3.

Typical polypus of the alveolar process in a girl of eight years.

FIG 4.



A second case of polypus, in a woman of thirty.

will be from a new point of the gum, and not at the point of original growth.

c. *Hypertrophy.*—Hypertrophy of the soft tissues over the alveolus and independent of it is a growth of the connective tissue between the bone and mucous membrane.

The enlargement is uniform, developing on both sides of the process and extending around the teeth. The margin of the growth is not defined as in the former varieties, but disappears in the normal mucous membrane. The surface is covered with normal mucous membrane. There is almost a bony hardness resembling osteoma odontoma and malignant growths during their early history. There is little if any pain and no other local or constitutional symptoms. The condition may be the early stage of epulis, but the cases operated were very different from cases of this condition under observation. They resemble or may be identical histologically with fibroid epulis as heretofore understood.

*Treatment.*—Treatment consists in removal by excision. They are not malignant and there is usually no return.

Fig. 5 shows a case of hypertrophy of the left upper alveolar tissue in a woman aged forty-five years. It has been growing for 18 months. The surface was smooth, uniformly developed and without symptoms. Removal was done by cutting to the bone on both sides. The process was severed with a circular saw on a dental engine. The section was below the nasal and antral cavities. The bone was not involved. Repair was prompt and there was no return in two years, when the patient was last seen.

The second case (Fig. 6) is very similar to the foregoing. The patient was about thirty-five years of age. The enlargement involved the right upper process from the median line to about the first bicuspid. The teeth had previously been extracted. The operation was performed as outlined in the former case. Repair was prompt and there was no return.

A young man aged seventeen years had a congenital hypertrophy of the left side of the face and a growth of the left upper alveolus, as in Fig. 7. It uniformly involved the process through-

out the left side. It was spongy, the remaining teeth were loose and could easily be moved. Putrefactive bacteria had produced an extensive suppurative and offensive condition. Before a radical operation was done a section was removed to determine its histological character, and while it was difficult to say definitely, owing to the disorganized nature of the tissue, it most resembled a fibroma.

*Operation* consisted in a complete removal of the growth including the teeth and alveolar process up to the antral floor, care being taken not to destroy the membranous floor of this cavity at points where the bone was removed. Hemorrhage was

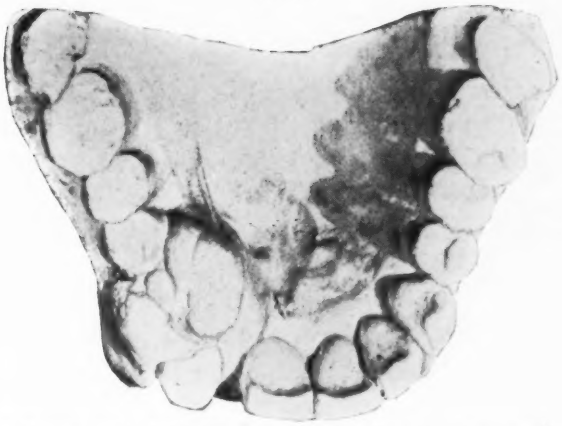
FIG. 7.

of course very extensive, but the blood was controlled by pressure. Repair was prompt and complete. It is now six years since the operation and there has been no return.

d. *Epulis.*—From the present day view-point epulis appears to include any variety of growth of the alveolar process which takes the form of a distinct tumor. During the early stages, unless a section is examined microscopically to prove its histological structure, it would be difficult to say whether it is a hyperplasia, fibroma or a sarcoma. The age of the patient has little to do with the development, although the majority have been observed in young manhood.

The most recent authorities divide the so-called epulitic growths into myeloid and fibroid, the former being growth of a spongy nature with irregular surfaces. The tendency is to grow in every direction and in some instances to carry the teeth along, as will be observed in the case reported. The surface is warty and the color conforms quite nearly to the normal mucous membrane during early development;

FIG. 5.



Hypertrophy of the left upper alveolar tissue in a woman of forty-five.

FIG. 6.

A case similar to the foregoing, in a patient thirty-five years of age.

FIG. 8.

Typical fibroid epulis. The growth was removed down to and including the external half of the process.

FIG. 9.

Result of operation in case shown in Fig. 8.

later, however, the color becomes a darker red and in cases that become infective and suppurative, reparative patches of a lighter hue will be found over the red surface.

The second, or fibroid epulis, is most common upon the mandible. During the early stage it resembles the myeloid type, but soon assumes a plum or a maroon color. There is a tendency to grow from the buccal surface. There is also tendency to develop in concentric forms, as may be seen in Fig. 8 as well as in Grunwald's case in Von Bergmann.

The differences of opinion that exist as to their character are considered and one writer says that he has not found either a lipoma, dental aneurism or enchondroma in the number and that there is no evidence of its ever being epitheliomatous. He states, in opposition to several authorities quoted, that none were true fibromas—six, however, being partly myxomatous; but he confirms the view that sarcoma is the commonest form, this being typical myeloid in character.

Hutchinson made a microscopic study of a case of myeloid epulis typical of myeloid sarcoma, with giant-cells. Nodules of bone were observed in the slide. It had been said that these tumors did not ossify, but he found the reverse to be the case. The plum color of the tumor was very characteristic. A case of epithelial epulis in a woman, aged 58, and successfully treated by partial excision of maxilla, is reported by Malloch.

*Diagnosis* must be made from simple acute inflammatory diseases that run an acute course, from polypi that have smooth surfaces, from cysts, hypertrophies, exostoses of the process, and malignant disease of the bone. The myeloid variety, as a rule, has a warty appearance and grows outward in every direction from the process, carrying along with it a tooth, or many teeth if unmolested. The teeth rest in a jelly-like mass insecurely and may easily be extracted. The surface when irritated bleeds readily, and sometimes alarmingly. In a recent case in the author's practice, a small portion was removed for microscopic examination and the hemorrhage was so profuse as to require constant pressure for half an hour to control it.

*Treatment.*—The treatment consists in early and effectual removal. The teeth must not be considered, since the growth usually includes the process down to the roots as well as the periosteum and mucous membrane. The accompanying cases will furnish typical examples as well as outline the treatment with results. Treatment for the fibroid variety is to remove without destroying the bone to any considerable extent. Repair follows and there is no tendency to return.

Fig. 8 shows a typical fibroid epulis. The growth had a maroon color. A tooth appeared to be the irritant, or the teeth that were included in the growth were thought to be the cause and were removed by a dentist. The growth as shown developed in three months. It was principally from the buccal surface and had a concentric tendency. It was soft and spongy and only slightly roughened.

*Operation* consisted in the removal of the growth down to and including the external half of the process. One tooth back of the tumor was included and required removing. Repair was prompt, the patient remaining in the hospital but three days.

The result is shown in Fig. 9.

### *B.* CHLOROMA.

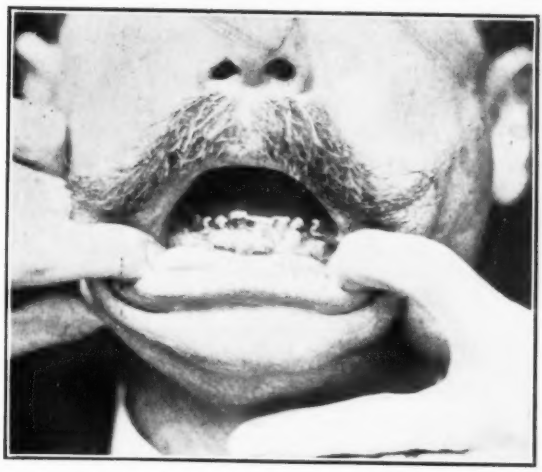
Apropos of the report of a case of this rare disease, in the ANNALS OF SURGERY, January, 1910, the following case is reported in connection with the tumors of the alveolar processes.

The hypertrophy began in the gingival mucous membrane throughout both maxillary bones, and extended from these points uniformly in every direction (see Figs. 10 and 11).

Photos were taken six months after the onset. The patient lived one year after this. There was no bone involvement. Very little local infection or abscess formation developed. The metastasis extended down the neck, the glands being involved but the skin was not affected. The growth extended across the roof of the mouth, and the oral mucous membrane was universally hypertrophied, so that he could take only liquid foods for several months before death. X-ray treatment made no impression.

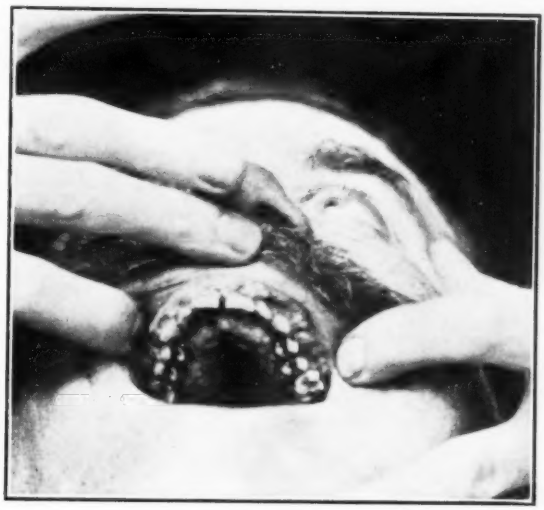
Microscopic examination did not show malignancy.

FIG. 10.



A case of chloroma—lower.

FIG. 11.



Upper.

FIG. 12.

Sarcoma developed from a case of necrosis following alveolar periostitis.

FIG. 13.

Epithelioma of the mandible.

### *C.* BONE TUMORS AND CYSTS.

(*a*) Exostoses or osteophytes; (*b*) osteomata or hyperostoses; (*c*) cysts of bone.

a. *Exostoses* or osteophytes are small, round, bony growths arising in the periosteum and spreading laterally as a result of inflammatory or traumatic disturbance of this membrane and its attachment to the bone. They are products of the periosteum, just as it reproduces bone after necrosis. They are composed of branching trabeculæ or sheaves filled in with cellular connective tissue or spongy formation. They have no clinical significance, do not cause death, and should be removed only when making pressure on other structures or their size demands an operation. Endosteomata are the same except that the growth is from the endosteum in the centre of bone. They have no clinical significance here. Exostoses of the accessory sinuses of the face are not uncommon. In the anterior or frontal sinuses they grow to enormous size. The growth is outward. They require removal when their size produces deformity. They are benign.

b. *Osteoma* or hyperostosis is a diffused new formation of bone or a growth including the bone in general and not circumscribed as in exostosis. The entire bone structure is involved. The growth, while occasionally circumscribed, is usually diffused, including a hyperplastic change of the cancellous and compact structure uniformly. It is found everywhere in the skeleton. A form is seen in the alveolar process, where it is usually diffused and the entire process is involved, but occasionally it is localized. An assignable cause (*i.e.*, a specified irritant) is not always obtainable. Leontiasis ossea is a typical disease of this variety.

c. *Cyst of Bone.*—A tumor beginning as a small enlargement of the alveolus usually upon the external surface. As a rule there is no pain or other inflammatory symptom. The growth is gradual, extending over a period of many months or years. The tumor is uniform, margins well defined. The mucous membrane over the surface is normal as a rule and

only becomes red when infection and pus formation occurs. The tumor may develop years after teeth have been removed and run the same course as other bone cysts.

*Pathology.*—The bone gradually melts away and the space is occupied by a fluid formation. The bone around the margin is usually elevated, due to the tendency of the periosteum that is left after the bone destruction to reproduce bone. The elevated margin recedes, however, as the cyst encroaches upon new bone. The external margin is denuded in the direction of the extension only, the remaining wall being well defined and composed of well-organized granulation tissues.

*Operation* requires free incision, removal of denuded bone, curettement of such portion of the cyst wall as appears incapable of repair. The cavity should be cleansed with pure alcohol, and only moderately packed, to control hemorrhage; subsequent packing should be to prevent the entrance of food only. The walls should be permitted to collapse so that the cavity may be obliterated as early as possible. The orifice should be kept open with packing until the deeper portion of the cavity has healed. Repair without complication or return may be usually expected.

An unusual tumor developed in the roof of the mouth, in a woman aged 30 years. It first appeared about the centre of the median line. It had been growing about two years when she asked for an operation. At that time the left nasal cavity and all but the upper part of the right was obstructed. The tumor projected downward flush with the teeth and filled the vault of the mouth.

### *D.* MALIGNANT TUMORS.

a. *Sarcoma* presents the most formidable and rapidly growing of all tumors involving the alveolar process. Recent investigations show that sarcoma is the result of trauma, as an injury from extractions or contusions or blows. Apparently simple conditions about the teeth requiring operations

may be followed by sarcoma. The growth is uniform, the course rapid, in a few weeks becoming many times the size of the bone itself. When involving the mandible it rapidly involves the skin, which breaks down, and as mixed infection occurs the discharge becomes profuse and offensive. Further skin and soft tissue are involved. The glands toward the clavicle are enlarged and become suppurative during later stages.

*Symptoms.*—It usually occurs in young manhood from fifteen to twenty-five years. The growth is rapid and painful. Temperature from 99 to 101 degrees is usually found before suppuration and higher after systemic toxæmia from absorption following suppuration.

*Diagnosis.*—It must be differentiated from the various forms of bone infection during the stages of sequestration. The bone may be cast off, resembling periostitis. Syphilitic gummata resemble sarcoma very much and the rapidity of the latter, along with the age (sarcoma in young manhood and syphilis at all ages), exostosis and osteoma are not usually confounded since they are characterized by a uniform, painless enlargement without suppuration. Carcinoma must also be excluded since the latter occurs in middle life and the growth is slow.

The case illustrated in Fig. 12 presented the usual symptoms of necrosis following alveolar periostitis, extending over a period of several months. No signs of growth were present. The sequestrum was removed and a favorable prognosis was made. The patient left the hospital in one week. Four weeks later she returned with an unmistakable sarcoma. Four weeks after this, the growth seen in Fig. 12 had developed. It was inoperable, since complete enucleation could not be promised. Under trypsin amylopsin treatment the development was checked. It remained latent during two months' treatment, when the patient withdrew, and at the end of another month it began to grow and she died in four months.

*Treatment.*—Early diagnosis and removal is most vital. When operation is not done it is best controlled with judi-

ciously administered X-ray treatment, followed by the removal of the tumor as soon as the rays have controlled the growth. Many cases are in this way cured and all are greatly benefited.

b. *Epithelioma* of the tissues overlying the maxilla and mandible develop as a result of some chronic irritant. Bad teeth are most frequent causes. A rough tooth constantly coming in contact with adjacent mucous membrane, or excessive tartar and spiculæ of bone in neglected mouths are fruitful causes. Papillomata, epulitic or other fibromata when cauterized frequently for their removal, as is too often practised by dentists, result in malignancy. Many cases of this character are reported.

*Symptoms.*—The growth is slow and not painful until it reaches considerable size. It is found in middle or advanced life. It involves neighboring lymphatics. The tumor as it is found in the mouth is irregular, warty, the normal mucous membrane entirely disappearing. Further extension includes the skin. Suppuration as a result of mixed infection with the usual constitutional symptoms must follow. It then becomes very painful.

*Diagnosis* must be made from sarcoma, gumma, periostitis, osteomyelitis and actinomycosis. Sarcoma involves the entire bone but the tendency is to enlarge outward. In carcinoma the growth extends under the tongue and in every direction uniformly.

*Prognosis* is toward a fatal end unless extirpation is done early and effectually.

*Treatment* now is enucleation followed with Röntgen rays for several months to destroy the cells in the deep structures, if any remain, and to prevent return in scar tissue.

In the case shown in Fig. 13 operation consisted in opening into the tumor by incision from before backwards. The contents were cheesy. The cavity was as large or larger than a hen's egg. Several roughened, bony points were found and curetted. Hemorrhage was quite free but easily controlled by packing. The nasal and antral cavities, while encroached upon, were not

entered, since the origin of the cystic material was from the oro-nasal partition and the membranous floor of the cavities was simply pushed in every direction by the gradual accumulation of this material. No complication occurred during recovery. The walls of the abnormal cavity, so widely extended, gradually collapsed and approximated. Only moderate packing was used. At the end of three months the cavity remained as a small sulcus communicating with the mouth and causing no inconvenience.

### CYSTS AND TUMEFACTIONS FROM TEETH.

*A.* Impacted teeth.

*B.* Delayed eruption.

*C.* Cysts from the roots of developed teeth.

*D.* Cysts and tumors in connection with the teeth during their development.

### *A.* IMPACTION OF THE TEETH.

Teeth occasionally fail to erupt. The process of budding may be in the wrong direction, and the tooth grows upwards or to one side, or some obstruction may interfere with the normal eruption, and instead of the crown pushing its way through the alveolus it grows in the opposite direction.

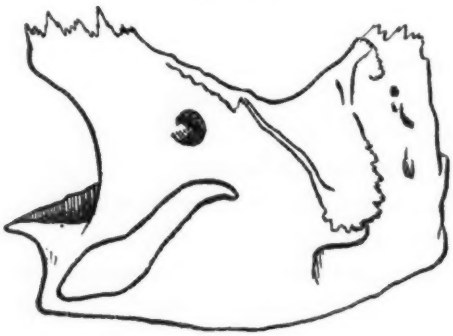
Discharging sinuses from the maxilla are not always evidence of disease of the antrum or other sinuses or of osteomyelitis or tubercular bone disease. These sinuses are not infrequently the result of an impacted tooth.

Indeed, all sinuses which give a chronic history associated with slight or possibly no pain when the sinus is opened, extending over a period of years, are more likely to be caused by non-eruption than destructive bone disease.

Mrs. A. T., aged forty-nine years, had suffered with pain in the right maxilla, just external to the ala, for 19 years. There had never been any discharge for 16 years, when a small opening which discharged small quantities of pus and serum was discovered internal to the second incisor. This has remained open for three years; occasionally it would close and be followed by pain which continued until spontaneous eruption relieved the suffering

(Fig. 14). An effort to determine whether it was a case of necrosis or impaction resulted in a decision of the latter for the following reasons: (1) In necrosis a greater amount of tissue would have been involved. (2) The character of discharge would have been pus at all times, usually of an offensive odor. (3) The patient was uncertain as to the eruption or extraction of the second incisor. (4) In osteomyelitis or tubercular bone disease a sinus would have formed long before it appeared in this case. (5) Associated symptoms, as swelling, involvement of secondary structures, as the antrum, would have resulted; none of which was ever present. (6) The general health of the patient would have been impaired.

FIG. 14.



An operation under general anæsthesia consisted in enlarging the opening in the mucous membrane along the line of the alveolus. As the sinus in the bone was slightly back of the alveolus, the bone was cut inward with a chisel. After excavating the opening sufficiently to admit a pair of bone forceps, they were entered with some difficulty, and a tooth was dislodged from its abnormal location. The depth of the cavity thus left after the removal of the tooth was two inches, as determined by actual measurement.

The subsequent history showed that no foreign substance had been allowed to remain, and the sinus was entirely closed in a week and has remained so and free from pain for four years.

Two cases very similar to the foregoing are appended.

Mrs. S., aged fifty-four years, had had her teeth extracted when thirty-five years old and had worn a full upper vulcanite

plate for 15 years with perfect comfort. After wearing a new plate for several weeks she returned to the dentist and accused him of making the suction cavity too large, dead bone resulting in the roof of her mouth. A careful examination revealed the existence of a tooth slightly to the centre of the oral vault. There was a very small sinus; the orifice was not granular as it would have been were dead bone present, and there was but slight discharge. A probe came in contact with a smooth hard substance characteristic of a tooth. An operation was advised and accepted. A canine was removed perfectly developed. The wound promptly repaired, and a malpractice suit was averted (Fig. 15).

Another case was that of a woman aged twenty-four years who had been wearing a full upper plate for about two years. A sinus was discovered in the roof of her mouth slightly to the left. A

FIG. 15.

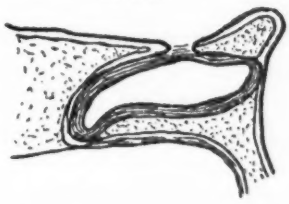


FIG. 16.

second sinus opened on the labial aspect of the alveolus. Upon introduction of a probe it came in contact with a tooth. Under somnoform anæsthetic it was removed. Repair followed without complication, and so little change occurred that the plate used before the operation fitted perfectly afterward (Fig. 16).

An interesting case of multiple malposition with cysts evidently becoming suppurative is that of a young man of twenty years who had had discharging sinuses and tumefactions of the right maxilla for eight years. A sinus led into the right cuspid and another into the right upper molar with other sinuses extending back of the maxillary bone on both sides well into the zygomatic fossæ. The patient had had two operations, one for mastoids and the other for necrosis, but in neither instance were the impacted teeth found (Figs. 17 and 18).

Operation included the removal of the impacted teeth with curettement, and repair followed in the course of a few weeks with no further symptoms from the maxilla. The patient returned

in three months with an enlargement over the lower left second bicuspid. This tooth had not erupted. An operation was performed and this tooth, imbedded in cystic material, fully developed, was removed after chiselling away sufficient of the external table.

The patient returned when he was twenty-seven years old with tumefactions on the external surface of both angles of the maxilla. These enlargements were the size of a silver quarter and at least half an inch outward from the bone. With the knowledge that neither one of the lower third molars had erupted and with the experience that had been furnished from the other teeth, diagnosis of cysts developing from the impactions was readily made out. Operation was performed and the teeth were removed.

The cysts had become suppurative and offensive and required irrigation for about three weeks. The cavities, which were quite large, finally collapsed and were entirely obliterated (Fig. 19).

Miss B., aged twenty, had been suffering pain in the region of the superior molars since her twelfth year. She knew that her twelfth-year molars had not erupted and was of the opinion that they had something to do with her suffering. This appeared to be quite evident.

Operation was advised, and under chloroform an incision was made from the first molar backward along the crest of the alveolus. The incision was extended down to the bone. The soft tissues, including periosteum and mucous membrane, were dissected back from the alveolar ridge so as to permit freedom in further operation. The tooth was found partially covered with bone. This was chiselled away and the tooth was pried from its position with a bone elevator. The crown of the tooth pointed directly forward and rested against the first molar (Fig. 21). The roots projected slightly downward parallel with the long axis of the alveolus.

The operation on the other side was exactly the same, the tooth was found in the same position. The flaps were adjusted and secured with catgut sutures. Repair followed without complication.

The case is unusual because of the bilateral condition, the teeth on both sides being in the same position.

FIG. 17.

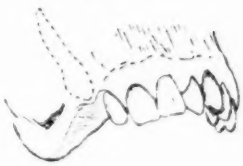


FIG. 18.

Multiple malposition with cysts becoming suppurative.

FIG. 19.

Cyst of mandible.

FIG. 20.

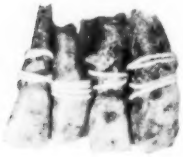
Cyst of mandible from two impacted teeth at right angles to each other.

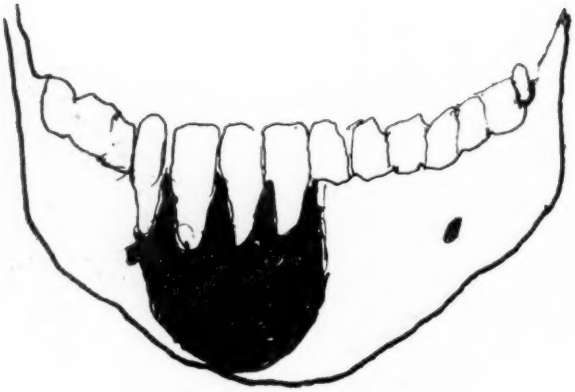
U of M

FIG. 22.

Cyst from delayed eruption.

FIGS. 23 AND 24.





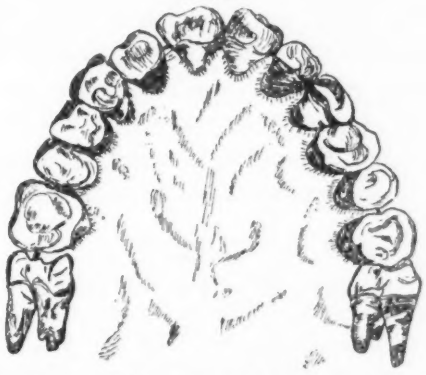
Cyst from the roots of developed teeth.

### *B.* CYSTS FROM DELAYED ERUPTION.

The teeth do not always erupt at the usual time, because of some obstruction at the point of usual exit or because of cystic or perverted development. In some instances the development is outward and an enlargement is formed, in some cases so large as to attract the attention of the dentist, who, if he does not suspect the real condition, will send the patient to a surgeon and an operation is too often performed.

The principal diagnostic point is the absence of the tooth, when it should have erupted. While there is some discomfort —even more than is usual with ordinary eruption—the pain

FIG. 21.



is never very severe. There may be nervousness, slight fever, loss of appetite, but all symptoms are mild. No operation should be done unless the delay extends over several months, or special reasons exist for surgical interference, such as suppuration, unusually large tumor, etc. If left undisturbed they will make their own way through the usual canal.

A case in point is that of a girl ten years old, who had been examined by dentists and doctors for a tumor over the root of the left lower cuspid (Fig. 22). It was half an inch in circumference and almost as high, and gradually increasing in size. Further examination revealed the same condition just beginning on the opposite side at the same point. During the course of the next six weeks, the cuspids above showed the same tendency toward development outwards.

*Treatment.*—It is proper to permit the teeth to develop uninterrupted until they erupt, and when not in proper position the orthodontist will be able to correct defects and deformities.

### *C.* CYSTS FROM ROOTS OF DEVELOPED TEETH.

A second and more common form develop from the roots of teeth after eruption. One or several teeth may be included. The roots of the teeth involved melt away, thus destroying the blood and nerve supply. The growth is usually upon the external surface only, because there is less resistance in this direction. They are doubtless caused by periostitis of the roots. The inflammatory process is of a low grade and seldom becomes an active suppurative condition. The fluid is turbid. The cavity is quite distinctly outlined. The apices of the teeth extend into the open cavity and are denuded back to the bony wall. When they develop in the maxilla adjacent to the antral floor this cavity is usually involved. In some cases they become suppurative and a diagnosis is more difficult.

The case shown in Figures 23 and 24 was a woman about thirty-five years of age. The lump had been growing gradually for more than two years. The cavity contained a thick straw-colored liquid with some shreds. The wall was well defined but irregular. The roots of the teeth stood out into the cavity, imbedded in the fluid. They were denuded back to the bone and the entire external table was destroyed to the gingival margin. The apices were gone, thus destroying the blood and nerve supply.

*Treatment.*—The operation was done through the mouth, and consisted in making an incision down through the centre of the tumor, evacuating the contents of the cyst. The teeth were removed without difficulty. Such portions of bone as were thought to be dead were removed. The subsequent history was uneventful; repair followed rapidly.

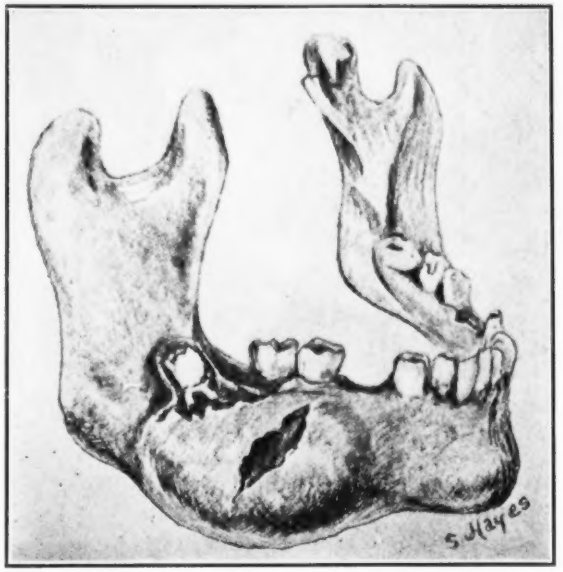
### *D.* CYSTS AND TUMORS IN CONNECTION WITH THE TEETH DURING THEIR DEVELOPMENT.

*Developmental Tumors.*—Neoplasms that have as their cause some portion of the teeth during embryonic develop-

FIG. 25.

Colored girl, nineteen years of age. Tumor of thirteen years' duration in connection with teeth during their development. Complete resection was performed. Patient died at end of the third week from abscess of the lung. (Bloodgood.)

FIG. 26.




Reconstructed lower jaw in a case of dentigerous cyst. The expansion of the body, chiefly on the outer side, is well shown and the recess containing the non-erupted wisdom tooth. (Bloodgood.)

ment are not uncommon. The literature is not extensive and the classification given by Bland-Sutton twenty years ago has not been changed.

They are tumors originating from one or more of the dental tissues of the tooth germ during the process of development. They differ from impaction in that the tooth does not develop properly and some portion of the histological structure is the nucleus and enters into the formation of new growth. They also differ from those having their origin about the roots of matured teeth.

The following summary of odontomata is taken from Bloodgood:

In his analysis of ten cases: upper jaw, 4 cases; lower jaw, 4 cases; ethmoid, 2 cases. The ages of the patients varied from 6 to 30 years, 4 were under 15 years of age, 6 between 20 and 30. The duration of the tumor varied from three months to thirteen years.

*Etiology.*—Writers have not agreed as to the real cause of tooth cysts. Sutton says: "Histologically, an epithelial odontoma consists of branching and anastomosing columns of epithelium, portions of which form alveoli, the cells occupying the alveoli varying, the outer layer being columnar, while the central cells degenerate and give rise to a tissue resembling the stratum intermedium of an enamel organ. They probably arise from persistent portions of the epithelium of enamel organs."

Sutton's classifications of developmental neoplasms of the teeth are as follows:

Odontomata: (1) epithelial (enamel organ); (2) follicular (fibrous, cementous, compound); (3) radicular (from the root); (4) composite (from the whole germ).

1. *Enamel organ* tumors are developed from the epithelial cysts—usually multilocular—filled with mucus and having a red circumferential area resembling sarcoma. They develop from 18 to 23 years of age generally, but may appear at any age. Their origin is probably from persistent remains of epithelium of the original enamel organ.

2. *Follicular Odontomata.*—These tooth tumors, according to Sutton, appear in three forms. Unless the successive stages are studied microscopically, the follicular and fibrous forms and the composite variety present very much the same characteristics. They are typical of the so-called dentigerous cysts.

They develop from the permanent teeth, usually the molars. The wall is formed by the expanded tooth follicle, which is filled with a viscid fluid and in which is found the imperfectly developed, loose, and displaced tooth. They may grow to enormous size, causing great deformity. This variety is known as *fibrous.* The cyst wall usually calcifies. The cementum of the tooth, *i.e.,* structure which gives origin to the cementum of the tooth, had to do with the calcareous change above mentioned, hence the name sometimes used, *cementoma.* Two or more tooth follicles join in the process, when it is known as *compound* follicular odontoma. Dozens of these tooth-like bodies have been removed from such a cavity. They rarely, if ever, suppurate.

Bloodgood says: "Under the microscope one sees the normal mucous membrane of the gum, then a zone of connective tissue, beneath which is the circumscribed tumor. The tumor is composed of branching epithelial alveoli in a connective tissue stroma. Some of the alveoli are cysts lined by the typical basal adamantine epithelium. Other alveoli are solid with cells showing the various morphologic changes of the adamantine epithelium."

*Cementous Follicular Odontoma.*—Referring to the above classification certain tumors take upon themselves the consistency of a tooth and may be a simple budding from the side of a tooth, from the root, or the crown, or the cementous growth may include the entire tooth, leaving only one place on the crown projecting to identify it with the particular tooth.

3. *Radicular odontoma* differs from the former in that the crown of the tooth does not enter into the diverted process, as it is composed of unalterable enamel. The dentine and cementum enter into the formation in varying proportions. The tooth erupts, but loses its identity in the tumor which is

attached to the base. It is rare, and seen more frequently in the lower animals.

4. *Composite odontoma* comprises a combination of two or all of the tissues of the teeth, as the cementum, enamel, and dentine may be involved. The normal tooth structures are entirely displaced by the new process. In other regards they do not differ from the first three varieties.

*Symptoms.*—The symptoms are tumefaction, beginning as a rule from the side of the alveolar process, increasing outward uniformly in all directions, or if they develop from a buccal root the enlargement will be inward. The growth is not rapid, requiring many months to produce much deformity, but as it is progressive there is no limit to deformity if left unoperated. Pain may be severe and is caused by the pressure upon the normal nerve terminals and surrounding structures. There are no constitutional symptoms from the tumor *per se*, and when present the result is involvement of adjacent vital tissues.

*Diagnosis.*—Broca says, "That any new growth of the jaw which occurs after complete development of the teeth is certainly not odontoma."

The diagnosis is very important, since odontoma is frequently considered malignant and the entire maxilla and half of the mandible have been removed, because malignancy was diagnosed when a postoperative dissection revealed an odontoma. No tumor beginning in the alveolus should be removed until odontoma is excluded. This may be done by passing a sterile needle or awl into the tumor at several points, or an exploration incision may be made and the central structure examined. The incision should be made in view of the radical operation in case malignancy is found. Having this in mind, useless sacrifice of tissue is prevented. Firm pressure upon some of these tumors reveals a parchment-like crackling.

A most frequent mistake of the general surgeon, who is on the lookout for sarcoma, osteoma, etc., and seldom sees a dentigerous cyst or a tumor due to noneruption, is to confuse the graver condition with the latter. In this event he makes a complete removal of a maxilla or half of the mandible.

After the operation is completed and the tumor incised a tooth is found in the centre. Had the true condition been suspected it would have been removed, and such abnormal process of the bone as was found chiselled away, the cavity curetted, and in a few weeks repair would have followed without deformity or destruction of functional usefulness of the parts.

*Differential diagnosis* must be made from the teeth and bone cysts, osteoma, exostosis, sarcoma, carcinoma, actinomycosis, and the swellings associated with chronic bone diseases as osteomyelitis, syphilitic gumma, and tuberculosis.

*Treatment.*—The treatment of the simple variety is, according to Hektoen, obviously plain and efficacious, namely, to incise the cyst as early and as thoroughly as possible, remove the impacted rudimentary or full grown tooth, scrape away the epithelial lining and pack the cavity with suitable material. In some instances it may be necessary to remove part of the jaw and of the cyst wall in order to gain access to the cavity. Many surgeons advise that such operations be made as often as possible from within the mouth. While surgeons have erred in making too aggressive operations in case of simple dentigerous cyst, error has also been committed in treating proliferating cystomata ineffectively, thus subjecting the patient to many operations, each with its risk, when one correctly performed operation would have been sufficient.

As already indicated, the surgeon should regard the incision into a supposed simple cyst as exploratory, because a differential diagnosis between a simple and a proliferating cyst, particularly in the early period of growth, cannot be made without direct inspection; and the surgeon should also prepare the patient, and be prepared himself, for the more severe operation, in case the growth should be a multilocular one. In fact, it would seem to be a good plan, as suggested by McLane Tiffany, in all cases of operation upon tumors of the maxillæ, to incise the tumor first in order to be absolutely certain that mistake in diagnosis may not result in an unnecessarily severe and disfiguring operation.

# FRACTURE OF THE HEAD AND NECK OF THE RADIUS.*

BY ROLAND HAMMOND, M.D.,

OF PROVIDENCE, R. I.

PREVIOUS to the discovery of the Röntgen ray this fracture was practically unknown, or was discovered only in anatomical dissections; it was regarded as a surgical curiosity. The first case was reported in 1834, as the result of a post-mortem examination. Up to 1880 but 21 cases were known, and of these 20 were discovered only after operation or dissection. As late as 1905, four years ago, the literature contained but 48 cases, only 8 of which had been recognized by clinical signs during life. At this time, four Röntgenologists in Philadelphia found 55 cases in their collections of plates, which exceeded the total number recorded at that period.

The literature of the subject has been thoroughly reviewed, and some excellent experimental work on the mode of production of this fracture has been done by T. Turner Thomas,[1] whose writings have placed this subject on a sound scientific basis.

The ever increasing use of the Röntgen ray in fracture work has revolutionized our knowledge of this subject. We are enabled to make a more accurate diagnosis, and with the knowledge thus gained to make a more careful reduction of the fragments without resorting to aimless and often harmful manipulation. We can then verify our results to ascertain whether the reduction has been properly accomplished. All this is well recognized.

But we owe a further debt to the Röntgen ray. Many fractures hitherto unknown, and formerly treated as sprains, have been brought to light, and many fractures thought to be rare are now known to be fairly common. Many frac-

* Read before the Providence Medical Association, June 6, 1909.

tures, from their obscure position or from the nature of their surroundings, give none of the well-recognized signs which we have learned to associate with a broken bone. Crepitus, abnormal mobility and impaired function are often absent, and pain may be the sole symptom to guide us in reaching a correct diagnosis. So it is with fractures of the head of the radius, and usually this condition is unsuspected until revealed by the X-ray plate. Its importance has been underestimated as well, for, on its recognition and proper treatment may depend the integrity and usefulness of two of the most important joints in the body—the elbow and wrist.

*Anatomy.*—The orbicular ligament and the lesser sigmoid cavity of the ulna form a sling in which the head of the radius rotates easily through nearly half a circle. Any injury at this point interferes with the important movements of pronation and supination, and, from its intimate relation with the elbow-joint, limits flexion and extension as well.

A fall on the hand is the most frequent cause of fracture of the radius at some point. Whether this occur at the wrist, in some part of the shaft, or at the head or neck of the bone depends on many factors. Turner has shown that the more nearly vertical the forearm at the time of the fall, the more likely is the force of the blow to be expended at the upper part of the bone, since in this position there is less cross-breaking strain. The tension of the muscles at the time of fall and the degree of rotation of the forearm also have an influence in determining the point of fracture.

*Diagnosis.*—As I mentioned above, the symptoms are deceptive. Pain is the only one I have found constant. Crepitus may be obtained in favorable cases on rotating the forearm, and this is the movement which usually gives most pain. Flexion and extension are ordinarily performed with less discomfort, but these movements may be painful. A point of localized tenderness is usually found over the head or neck of the bone. The diagnosis is made quickly and without pain to the patient by the Röntgen method, and this agent should always be employed. The objection of some writers

that this fracture is not shown, or is sometimes overlooked, by the X-ray, I have not found borne out by experience, if the pictures have been correctly taken. Oftentimes the anteroposterior and lateral views of the elbow-joint as ordinarily made are not sufficient to show this fracture clearly. Dr. Frank E. Peckham and the writer have devised an apparatus by which the head of the radius is brought in close contact with the photographic plate. This view, in connection with the ordinary anteroposterior and lateral positions, allows the bone to be viewed from all sides. By this X-ray study of the elbow the fracture is shown if present. In one of the cases given below, the views, as ordinarily taken, failed to show the fracture, until this procedure was employed.

The fracture may be of the fissure type, in a vertical direction through the head or neck, the fragment often being wedge-shaped, or the head may be impacted. In both of these types the fragment is usually in good position. There may be enough displacement to interfere with flexion as well as rotation. When the fracture occurs in the neck of the bone, the upper fragment is more likely to be displaced downward and outward, and can often be palpated. In these cases the disability is greater and the symptoms more pronounced. The head is often split into several fragments, one or more of which will be displaced, often to some distance, and may interfere with complete flexion of the elbow. This fracture is often overlooked, in the absence of the well-marked signs which accompany the more easily recognized fractures, and treated for a sprain or contusion. In these cases free use of the joint, which is often encouraged, may lead to permanent disability of the joint to some extent, or possibly to non-union of the fragment.

*Prognosis.*—This is good in the small class of cases where there is a vertical fissure through the head and oftentimes in the impacted cases. The fragments are held firmly by the orbicular ligament, which prevents displacement and encourages firm bony union. With comminution and separation of fragments, however, the chances of obtaining a perfectly use-

ful elbow are not so favorable. The extrusion of bone into the joint cavity and the formation of callus may interfere with flexion and extension as well as with rotation, and the patient should be warned of this possibility.

*Treatment.*—In cases with good approximation of fragments and but slight displacement, I have had the best results with the right-angled tin splint fashioned for the individual arm and supported by a sling. The splint should be left in place for several days to a week. It is then removed at intervals of two or three days and massage and gentle passive movements begun. These manipulations should be under the care of the physician, and great pains must be taken not to displace the fragments by injudicious movements, as has happened in the hands of an unskilled masseur. By the end of the third or the beginning of the fourth week the splint may be omitted and the arm carried in a sling for another week. At the end of this time all apparatus may usually be omitted. This early joint movement, when used with due care, will tend to preserve the mobility of the joint and prevent the formation of the firm adhesions and ankylosis which are the bane of fracture work. If the motion is begun early and continued with caution and regularity, it will be found, on omitting the splint, that the joint is much more useful than when continuous fixation has been employed. Most writers speak of limitation of motion as almost invariably present on removing the splints. This partial ankylosis may be eliminated in many cases if due care in treatment is exercised.

Where there is marked displacement of fragments which encroach upon the joint cavity, there will naturally be some ankylosis no matter what the treatment, and the question of operative interference arises. Each case must be judged on its own merits as shown by the Röntgen examination, but the best results will usually be obtained where a conservative method of treatment has been followed, leaving the open operation for those cases of displaced fragment with limited motion in the joint, or the rare cases of non-union. If the

plate show a fragment so greatly displaced, that, if left in position it will result in partial ankylosis, or is in danger of becoming a foreign body through non-union, it had best be removed at once by operation.

Bardenheuer[2] states that he has never found it necessary to operate on a case of this fracture.

As an aid in the after-treatment of these fractures, baking in the hot-air oven will be found of the greatest value in affording relief from pain and in restoring motion to the joint, and massage and passive motion are much more effective after such treatment.

In looking over our collection of plates, I find 11 cases * of fracture of the head and neck of the radius out of 224 cases of all fractures taken during the past three years. Of these 11 cases, five were referred for X-ray examination within a few days of the injury, and in no case was the condition accurately diagnosed until the X-ray plate had been taken. Four of the remaining cases were seen from three to seven months after the injury, and came for relief of pain or in hopes of obtaining a more useful elbow. In none of these cases, nor in the two which I have treated personally, was the diagnosis made until the Röntgen examination had been made. The cases that I have been permitted to see in the practice of other physicians have been very instructive. I believe the condition is a difficult one to diagnose, and in most cases impossible without the aid of the X-ray.

I have treated two cases of this fracture, both of the head of the radius. The first case occurred in the practice of Dr. Frank E. Peckham, and was treated by me during his absence. I am indebted to Dr. Peckham for the privilege of reporting this case.

Case I.—A young clergyman came to the office with an injury to the right elbow, of six days' standing. He had been thrown from his horse while riding. Pain was distinctly local-

* Since writing this paper three other cases of this fracture have been seen out of a total of 344 cases of all fractures.

ized at the head of the radius, most marked on rotation of the forearm, and to a lesser extent on flexion and extension. The X-ray examination (Fig. 1) showed a wedge-shaped vertical fracture of the head of the radius with slight displacement at the upper end. A right-angled tin splint was fitted and worn for three and a half weeks. The splint was left in position for a week, and was then removed every other day for two weeks, and then twice a week until finally omitted. At each visit the elbow was moved gently but as much as possible in all directions. On finally omitting the splint there was perfect function in the elbow in pronation and supination as well as in flexion and extension, and no pain was experienced.

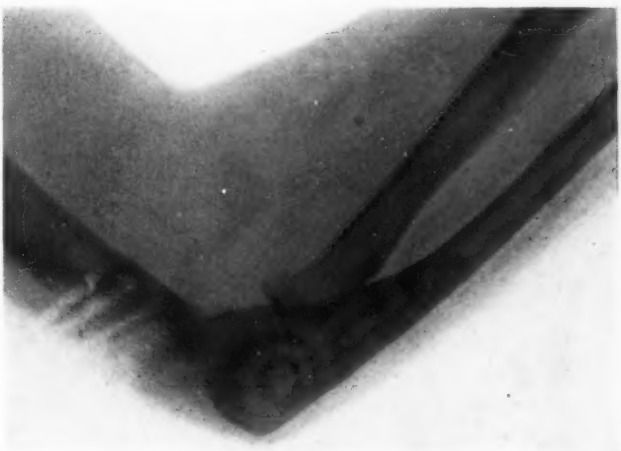
CASE II.—A physician, æt. 61, came to me for treatment of an injury to the left elbow. Five days previously, while coming out of his house, he had fallen on some stone steps, striking, he thinks, on his elbow. There was marked tenderness about the head of the radius, and motion was decidedly limited in all directions. The Röntgen examination made in the usual anteroposterior and lateral positions failed to show any fracture. This case resembled the first one so strongly, however, that I was convinced that some fracture was present, and the symptoms all pointed to the head of the radius as the most probable location. Accordingly, I placed the head of the radius in close contact with the photographic plate, and demonstrated a vertical fissure in the head with practically no displacement. The treatment was the same as far as splinting and manipulation were concerned, as in the preceding case. This injury occurred in sultry weather, and the patient suffered much pain. The splint was irritating and required frequent adjustment. On omitting the splint there was considerable pain, and some limitation in flexion and extension. The elbow was baked in a hot-air oven for four to five weeks, and at the end of this time complete function had returned, and pain was much less noticeable. The latter symptom was present to a slight extent for six months, but since that time, nearly two years since the fracture, the elbow has given no inconvenience whatever.

I have also had the opportunity of making a Röntgen examination in 12 other cases of this fracture occurring in the practice of other physicians. I wish to thank these gentle-

FIG. 1.

Vertical fracture of the head of the radius. Case I.

FIG. 2.



Impacted fracture of the head of the radius. Case VII. Patient of Dr. J. W. Keefe.

FIG. 3.

Comminuted fracture of the head of the radius with separation of fragment. Case XIV.

men for the courtesy of allowing me to describe briefly these fractures from a radiographic standpoint, and to add them to the scanty literature of the subject.

CASE III.—Female (patient of Dr. E. E. Moore). Right elbow. Oblique fracture of the head of the radius down through the neck, with splitting off and slight separation of fragment. Complicated by backward dislocation of the elbow which had been previously reduced.

CASE IV.—Female (Orthopedic Department, Rhode Island Hospital). Left elbow. Oblique fracture of head and neck of radius, with separation outward and forward of a fragment half the size of the head.

CASE V.—Female (patient of Dr. E. S. Allen). Right elbow. Slight separation of fragment involving about one-third of articular surface of radius, and vertical fissure extending down into neck. Upper portion of neck is bent inwards.

CASE VI.—Female (patient of Dr. F. E. Peckham). Right elbow. Similar to Case V in size and displacement of large fragment, but also slight comminution of fragments in joint.

CASE VII.—Female (patient of Dr. J. W. Keefe). Left elbow. Impacted fracture of entire head of radius with displacement forward, inward and downward.

CASE VIII.—Male (patient of Dr. H. DeWolf). Left elbow. Oblique fissure fracture of outer third of head of radius with almost no displacement of fragment.

CASE IX.—Male (patient of Dr. F. A. Fearney). Right elbow. Fracture of outer half of head of radius with displacement of fragment upward into flexure of elbow.

CASE X.—Male (patient of Dr. W. R. Morse). Left elbow. Comminuted fracture of outer fourth of head of radius. Slight displacement of main fragment, but a small fragment displaced one-half inch upward into flexure of elbow.

CASE XI.—Male (patient of Dr. E. C. Murphy). Right elbow. Impacted fracture of head of radius with slight displacement forward and outward.

CASE XII.—Female (patient of Dr. F. E. Peckham) aged five. Right elbow. Fracture and dislocation of head and upper end of radius for one-fourth inch below the epiphyseal line, and displacement of fragment, including small part of shaft, downward and outward.

CASE XIII.—Male (patient of Dr. F. E. Peckham). Right elbow. Oblique fracture of outer third of head of radius of the vertical fissure type. Slight displacement of fragment.

CASE XIV.—Male (patient of Dr. F. E. Peckham). Right elbow. Comminuted fracture of head of radius with separation of an irregularly shaped fragment upward into flexure of elbow.

The above cases were all adults with the exception of Case XII.

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# BACKWARD DISLOCATION OF THE UPPER END OF THE ULNA.

OLD, COMPLETE DISLOCATION OF THE ULNA ALONE, WITH ROTATION AROUND THE HEAD OF THE RADIUS. OPERATION: GOOD RESULT.

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BACKWARD dislocation of the upper end of the ulna alone, when complete, seems to be a rare lesion. Stimson, who gives an admirable classification of these injuries, describes three forms of dislocation of the upper end of the ulna.[1] The first form is that in which the displacement is slight; the ulna is carried backward and rotated slightly around the radius; and then, by adduction of the forearm or by upward movement of the ulna, the coronoid process passes behind the trochlea. In the second form, the coronoid process passes upward until it engages in the olecranon fossa. This requires that there shall be still more adduction of the forearm than takes place in the first variety. In the third form the rotation of the ulna around the radius continues until the ulna lies behind the radius.

Concerning the first form, it is the most common, and is spoken of as "incomplete." Stimson has been able to find only two recorded cases of the second form (the cases of Malgaigne and Wilson). I have not been able to find in literature a report or a description of any cases of the third form. The case herewith reported is such a one.

K. K., male, aged thirteen, jumped and fell from a wagon, striking upon his hand, forearm, and elbow. He suffered much pain; was unable to sleep for two nights; deformity of the elbow was recognized, and soon was obscured by swelling. He was not seen by a surgeon, but was treated with liniment. The elbow was stiff and painful. He was not able to use the arm. Gradually the swelling subsided. Pain was always present when the elbow

[1] Fractures and Dislocations.

was much moved. He was otherwise well. Nine weeks later the boy was taken to Dr. E. W. Skelton, who recognized the nature of the lesion and sent him to me at the German Hospital.

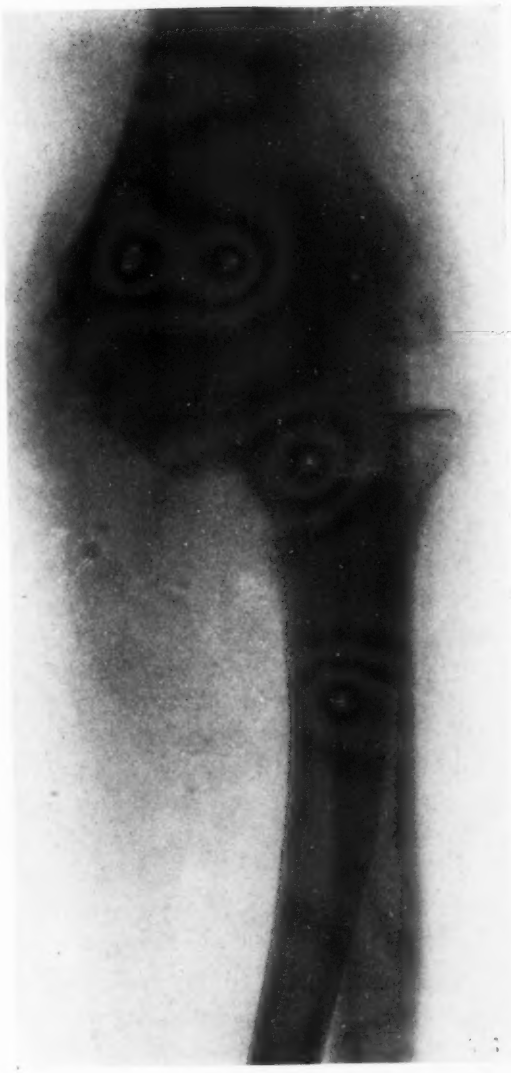
Examination showed the right ulna entirely absent from the trochlear surface. The radius was in its normal place. The upper end of the ulna could be felt lying posterior to the radius. External to the ulna, and connected with the outer condyle of the humerus, could be felt an irregular bony mass which was interpreted as the callus of a fracture of the condyle which had united in malposition. The forearm was in a position of flexion at an obtuse angle of about 150 degrees. Flexion and extension were possible through an arc of about 10 degrees. Supination and pronation were possible through only about one-fourth of their normal excursion. All of these movements were painful as they approached their limits. There was no œdematous swelling. The arm had undergone considerable atrophy. The X-ray plates showed the above-described conditions (Fig. 1).

Operation, ten weeks after injury: A long incision was made directly posterior to the displaced ulnar head. The ulna was found rotated just 90 degrees, so that the sigmoid notch instead of looking forward looked inward. The notch and the trochlear surface were covered with new connective tissue and adherent capsule. The connective tissue was dissected away from the articular surfaces; but when everything was freely cleared, it was impossible to rotate the ulna into place. Attention was then directed to the bony mass connected with the outer condyle. It was found that there had been no fracture as was surmised, but that the mass was an exostosis of new bone which had been thrown out beneath the stripped-up periosteum in front of the condyle. When this exostosis was chiselled off, the ulna rotated back into normal position with perfect ease. The wound was closed, and the arm was put up at a right angle in plaster of Paris.

At the end of two weeks, passive motion was begun; and at the end of three weeks the patient was allowed to use his arm. Motion of the joint steadily improved. There was no pain. At the end of two months the elbow functionated well excepting that flexion and extension stopped short of normal. The arm was strong, supple, and useful for every function for which it was called upon.

At the present time the arm is normal in both its anatomy and physiology excepting that extension and flexion cannot be carried quite to their full extent.

FIG. 1.



Outward dislocation of upper end of ulna. The upper end of the ulna is dislocated posterior to the head of the radius, and at the same time is rotated 90 degrees, so that the sigmoid notch and the coronoid process look inwards.

# AUTOPLASTIC TRANSPLANTATION OF BONE.

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THE conditions which make it desirable to replace bony defects are by no means of rare occurrence. Chief among them are deficiencies of the cranial bones, of the inferior maxilla, and of the long bones of the extremities, occasioned by osteomyelitis, by injuries, or by the removal of tumors. Finally, in a class by themselves, are the pseudarthroses.

Notwithstanding the frequent occurrence of all these conditions, the available methods of making good such defects have never been popular.

If, however, there does exist a satisfactory means of replacing these losses in the continuity of bone, its infrequent utilization is to be regretted, for consequential upon them must be mentioned not only a prolonged course of healing but frequently, also, serious deformities and loss of function, a loss often great enough to demand amputation.

In their views upon this subject surgeons have been influenced by the undesirability of implanting in a defect between or within bones any foreign substance, and their belief that all homoplastic grafts must be included in this category.

There is a manifest failure to appreciate the actual fate of a periosteal bone graft. The numerous successful osteoplastic operations upon the cranium, however, should encourage autoplastic transplantation of bone and periosteum in other locations. On numerous occasions bony buttons or chips have been replaced into cranial defects and successfully healed in. (Kuester, Von Jaksch, Watson Pike, Gerstein, William Jones, Von Braman, Weir, Moller, Eastman, Bunge, Macewen.)

Probably more to the susceptibility of bone and periosteum to successful autoplastic transplantation than to the preservation of the vascular supply must be attributed the success of

the Haeker-Durante sliding flap method (Durante, Haeker, Sultan, Borchard, Sohr); and it is not impossible that the same statement is also true of even the Müller-König method, for the retention of the vascular supply in either of these methods is small (Müller, König, Shönborn, Mikulicz, Braun, Slajmer, Gussenbauer, Riegner, Korte, Brenanto, Bernay, Von Eiselberg, Karewski, Milko).

It has long been appreciated that foreign bodies of almost any description can permanently be healed within wounds. A. Fraenkel first suggested the use of celluloid plates for the closure of cranial defects, and since that time the procedure has been frequently resorted to with a greater or lesser degree of success (Fraenkel, Billroth, Von Fillenbaum, Weinlechner, Hinterstoisser, Berger, Von Frey, Link, Porges, Fritsch, Pringle, Blecher).

Gluck, Bircher and König have described the successful replacement of losses of bone by pieces of ivory. König still enthusiastically advocates the procedure to correct the deformity produced by resection of portions of the inferior maxilla. Kopfstein replaced a resected upper portion of a humerus with a piece of ivory driven into the remaining part of the humerus below and fitted by a rounding of its upper extremity into the glenoid cavity (Bircher, Gluck, Kopfstein, König).

Lambotte and Elsberg have reported the implantation of aluminium plates within cranial defects and Gerster has utilized gold for the same purpose.

Perhaps the most remarkable instance of the implantation of foreign bodies is recorded by Giordano who permanently replaced a gap of 23 cm. in a tibia with a piece of metal capped on both ends with ivory disks.

Somewhat more extended use has been made of heteroplastic transplantation of bone from animals. Many successful cases have been reported. The literature dates back to 1682 when Jobi Meekren replaced a defect in the cranium of a soldier with a piece of a dog's skull. The implanted fragment healed in perfectly. It is interesting to note that antivivisection cruelty to human beings was in those days more

successfully active, and Jobi Meekren was required to remove the implanted fragment under the ban of excommunication by the church which refused to recognize such "unchristian" methods of treatment. "Chirurgicum ossis cranii fragmentum anferre jussit, sicque, curatione alia adhibita excommunicationis vim effugit. Jobi a Meekrenobservat medico-chirurg." Ex Belgico in lat. transl. of A. Blasio, Amsterdami, 1682, pp. 6–7.

Beginning in the year 1810, the following have reported successful heteroplastic grafting of bone: Merrem, Merrem and Von Walther, Flourens, J. Wolf, Ollier, Goujon, Marshall, Adamkiewicz, White, Sherman, MacGill, Sherwood, Ochotin, Chalot, Forgue, Le Dentu, Ricard, Perier, McGraw, Buchanan, Mosse, Kronacher, Petit, Patzauer, Smolony, Krausch, and Tomita.

Pathologically, of a similar nature is the filling in of losses of bone by decalcified bony chips, first proposed by Senn and subsequently reported upon by Deaver, Le Dentu, Middeldorpf, Mackie, Miller, Murray, Spediacci, Curtis, and Wagenknecht.

For the sake of completeness, reference will be made to the heteroplastic transplantations with preservation of vascular connections by Phelps and Morton, and also the iodoform plug of Mosetig Moorhof. The latter method has received favorable notice by a number of foreign writers and in this country by Wetherill and the Mayo brothers.

None of these methods can be said to be entirely satisfactory. Healing often occurs only after considerable length of time. The formation of fistulæ are not infrequent, and many times a number of the bony fragments have been discharged. In general, they offer a contrast to those cases in which defects in the continuity of bones have been replaced by the implantation of a fresh piece of bone together with its adherent periosteum which is taken from the same individual or another human being.

Recorded instances of this latter method are few in number. They nevertheless indicate that the procedure is one of real

value, and, if subsequent experience proves as favorable, the desirability of more frequently resorting to it is at once apparent and justifies the recording of the author's case.

CASE.—Patient, L. K., an American woman, at present forty-two years of age.

*Previous Personal History.*—When a child, had malaria and scarlatina followed by a mild nephritis, from which she apparently made a complete recovery. At eighteen years of age she married. During the next three years she had two miscarriages and one child born at term and dying of marasmus when it was five months old. This child had a bullous eruption upon the soles of its feet, some general eruption upon its body, and a condition of the eyes resembling parenchymatous keratitis. Subsequently, the patient had another child who is to-day healthy.

*Present Trouble.*—Twelve years ago the patient had a severe wrench to her arm, described as a pull accompanied with a sudden twist. She felt considerable pain after this, and three months later she noticed a lump in her arm. This gradually increased in size until seven years ago when she received without benefit a course of mixed treatment.

The growth at that time was hard, nodular and immovably bound down by the muscles of the forearm, in which it caused a fusiform enlargement five inches in length. The whole tumor was exposed and found to be attached to the anterior surface of the ulna by a flattened pedicle. It was removed and the ulna at the point of attachment of the growth curretted. In one year's time a recurrence of the growth was noticed. The recurrent mass measured about two inches in length and was attached to the ulna at the juncture of its lower third and upper two-thirds. This mass was extirpated under general anæsthesia and one year and three months later another small nodule was excised under cocaine. Again, within a few months, a fourth recurrence of the growth was noticed. The patient, however, neglected treatment until November 26, 1908, one year and three months after the preceding operation. She was then placed under the author's care in the Francis E. Parker Memorial Hospital, New Brunswick, N. J.

Fig. 1 represents the size of the growth at that time when the final operation was undertaken. Through an incision along the

FIG. 1.

Condition of forearm immediately previous to operation.

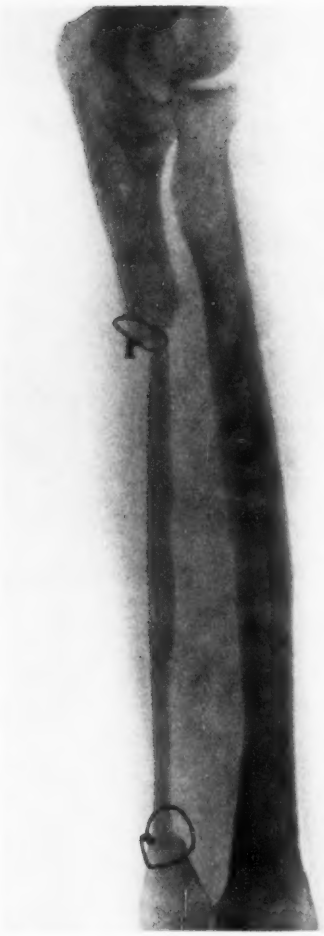
FIG. 2.

Condition after healing of operation wound.

FIG. 3.

Condition of bones one month after operation.

FIG. 4.



Condition of bones four months after operation.

FIG. 5. FIG. 6.

Condition of bones fourteen months after operation.

posterior border of the ulna and dividing the joined aponeurosis of the extensor and flexor carpi-ulnaris, the tumor was removed by resecting a portion of the ulna five and one-half inches long, which ran through the centre of the growth.

A fragment of bone of the same length and three-eighths inch wide and one-eighth inch thick was now chiselled off from the crest of the tibia together with its adherent periosteum.

This was then placed between the two extremities of the ulna remaining and fastened in place with silver wire. The periosteum of the implanted fragment was also sutured to the periosteum of the remaining portions of the ulna. The wound was now closed with the exception of a small drain at each end.

After the first twenty-four hours the drains were removed and a plaster splint applied. Thereafter, the wound was dressed on the fourth, seventh, and tenth days, at the end of which time it was healed throughout. At no time was there any elevation of temperature. In two months time the patient could freely use her arm for washing clothes at a tub. Fig. 2 illustrates the healed condition of the arm. Microscopical examination showed that the growth was a chondrosarcoma.

The accompanying radiographs were taken at intervals of one month (Fig. 3), four months (Fig. 4), and fourteen months (Figs. 5 and 6) after the operation. They demonstrate the increase in thickness of the implanted fragment and the formation of callus at its upper end by the implanted periosteum, and at its lower end the direct union of the implanted piece with the ulna.

If we inquire into the nature of the histological processes which have taken place, we must assume as a result of the conclusions of research work upon implanted bone and periosteum that the implanted bone itself had died, but that the periosteum and marrow lived and replaced the old bone with new.

As long ago as 1867 Ollier recognized the important rôle played by the periosteum and marrow. He states: "Quand on a transplanté un os entier, ou une portion d'os garnie de son périoste et de sa moelle, il arrive quelquefois que le périoste seul se greffe; le cylindre osseux se nécrose, se détache, est eliminé, et l'on trouve cependant dans le lieu de la transplantation la gaine périostique ossifiée. Par sa surface externe elle

a adhére aux tissus voisins, et c'est ensuite séparée de l'os ancien nécrosé."

And referring to an experiment in which he successfully transposed the radii of a rabbit he states: "Cette observation nous paraît demonstrer à elle seule la plupart des propositions que nous émises dans ce chapitre la réalité de la greffe osseuse et le role du perioste et l'utilité de cette membrane, même dans les cas ou le tissu osseux lui même ne se greffe pas."

Subsequent work has, in a large measure, verified and at the same time amplified Ollier's work.

There is a general agreement between the conclusions of Radzimowski, Bonome, Saltykow, Fischoeder, Marchand, Sultan, Tomita, Grohe, Morpurgo, Läwen, Barth (latest publication) and Auxhausen. An examination of the only dissenting works by David, Adamkiewicz, and Laurent, who alone maintain the viability of the implanted bone, will not support their opposing claims.

All others have recognized the death of the implanted bone, its revascularization and penetration by granulation tissue, and through this means the formation of new Haversonian canals, the lining of the new vessels with osteoblasts, and by their agency the absorption of the old bone and the deposition of new bone in concentric layers around the new formed vessels. Finally, that these changes are solely dependent upon the living and regenerative power of the transplanted periosteum and marrow.

The remarkable viability of the transplanted periosteum has been demonstrated by Grohe and Morpurgo, the former showing that it is capable of preservation for one hundred hours and yet able to be implanted and exert its osteogenetic powers. The latter has shown that the periosteum of a corpse kept at 15° can produce new bone when implanted after one hundred and sixty-eight hours. Läwen has recommended the use of periosteum in the repair of ventral hernia.

The histological demonstration of the viability and regenerative power of implanted periosteum at once places homoplastic transplantations of bone upon an entirely different

footing from any other method of making good bony defects. When the cases of the former method of transplantation are compared with those in which there has been transplanted bone from animals or decalcified dead human bone (Krausch), or even live human bony chips (Macewen), a difference seems to exist in the course of healing of the wounds, in the character of the end result, and in the rapidity with which the latter is obtained. In addition to the author's case, other cases of rather extensive homoplastic transplantation of bone have been reported by Poncet, Kummel, Bardenheuer, Von Bergmann, Klapp, Curtillet, Tomita, Perthes, Lexer, Frankenstein and Rovsing. Similar small transplantations have been made by Timann, Tietz, Müller, Von Mangoldt, Dryden, and Auxhausen.

In one of Bardenheuer's cases half of the ulna was used to replace a radius.

In Von Bergmann's case a portion of the tibia 11 cm. long was resected for sarcoma and replaced by a piece taken from the fibula.

Klapp replaced the whole of the diaphysis of the humerus (also resected for sarcoma) with a piece of bone and periosteum removed from the crest of the tibia.

Tomita has reported five cases of bone transplantations, two of these were heteroplastic, one was for a pseudarthrosis, and two were fairly extensive autoplastic implants. In one of the latter, a portion of the tibia 8 cm. long was implanted into a defect 6 cm. long lower down in the same bone.

In the other, a piece of the left tibia 7 cm. long was implanted into a defect of 5 cm. occurring in the tibial diaphysis.

Frankenstein resected 25 cm. of a femur for sarcoma and implanted within the defect a resected fibula. The implanted bone healed in well and formed firm union below, but a pseudarthrosis resulted at the upper end of the implant. In seven months' time the patient died of metastases. Sections of the removed transplanted bone showed active proliferation of its periosteum and marrow and a replacement of the old bone by a network of newly deposited osseous tissue.

Finally, and of considerable importance, is the transplantation of joints by Lexer. In his first publication he reports four functionally successful cases in which portions of bones with adjacent parts of joints have been replaced by bone and cartilage covered with their periosteum or perichondrium.

In his second publication he adds the report of a total transplantation of a knee-joint in a girl eighteen years of age. In eighteen months' time the patient could walk with only a slight limp and rocking of the knee-joint.

Läwen has reported the replacement of the upper half of a humerus resected for sarcoma with a portion of bone and periosteum removed from a tibia. In Rovsing's case two-thirds of the humerus was replaced by the patient's own fibula.

These cases are not numerous but they are sufficient to illustrate the possibilities of homoplastic transplantation of bone and the superiority of the method compared to heteroplastic transplantation or even, as in the case recently reported by Macewen, to the implantation of fresh human bone chips.

Both Tillmann and Tomita, but particularly the latter, who has tried several methods on the human, have commented on this superiority. Tomita states: " Aus den oben aus einander gesetzten Gründen spechen unsere Fälle vielleicht dafür, das die methode mit homoplastischer oder autoplastischer Füllung die bessere ist."

Certainly in the author's case the healing of a simple green-stick fracture could not have been more simple; and the ultimate cosmetic and functional result is all that could be desired.

In conclusion the case illustrates the peculiar adaptability of the tibia (its accessibility and its great strength and thickness) to the function of furnishing a suitable bony graft. The radiographs (Figs. 3 to 6) demonstrate that such an autoplastic graft firmly unites to the fragments between which it is placed and eventually becomes transformed into a thicker piece of living bone, its thickness being determined by the demands for strength required in its new situation. Finally, in the case cited the smooth and rapid healing is an indication that the autoplastic method of remedying bony defects is the pro-

cedure of choice and is deserving of wider application than it at present is receiving.

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# SPONTANEOUS FORWARD DISLOCATION OF WRIST-JOINT.

(MADELUNG'S DEFORMITY.)

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IN reporting these cases we are familiar with the recent articles upon the subject in the German, French and English literature, the only article of any consequence in English being Stetten's [2] in the *Journal of Surgery, Gynecology and Obstetrics* for January, 1909, who collected 62 cases, some of which we are unable to locate. Our cases and the literature were observed and collected before the appearance of Stetten's article. We feel confident, however, that in view of the lack of literature dealing with this disease in America another short review with report of two cases is justifiable.

*History.*—Dupuytren [4] seems to have been the first to call the attention of the profession to this disease, although Begin [5] made a note of such a condition in a book published in 1825. In 1834 Dupuytren first described it at length, and later referred to another case which appeared in his clinic in 1841. In 1835 Lesauvage [6] described what he called a "Luxation consecutive de L'articulation radiocarpienne" in a thirty-two year old soldier. In 1847 Smith [7] reported two cases in his text-book. In 1847 A. Nélaton [8] refers to a specimen examined by Boinet where unilateral forward displacement was present. In 1855 Malgaigne[10] described a case in a young boy twelve years old, a mason's apprentice with a unilateral forward dislocation of the wrist. Weber [11] in 1859 described a case in a young girl eighteen years of age. The wrist was displaced forward, movements were painful and extension very limited. In 1864 Busch [12] referred to a case of marked bilateral forward dislocation of the wrist-joint.

The first anatomical dislocation was reported by Jean [13] in 1875. Stimson [14] and others doubt whether in this case there was not an old Colles's fracture. To Madelung [15] belongs the credit of first describing this condition in detail, and he reported same at the "Deutsche Gêsellschaft für Chirurgie" in 1878 under the title of "Die spontane Subluxation der Hand nach vorne."

The history of our cases is as follows:

Case I.—H. J., a girl, fourteen years of age, born in America of Swedish parentage, presented herself for examination in November, 1907.

*Family History.*—Father died at the age of sixty-two from an accident. Mother living, strong and healthy, her present age fifty-four. Has five brothers and two sisters, two of whom died in infancy. The living are all strong and healthy.

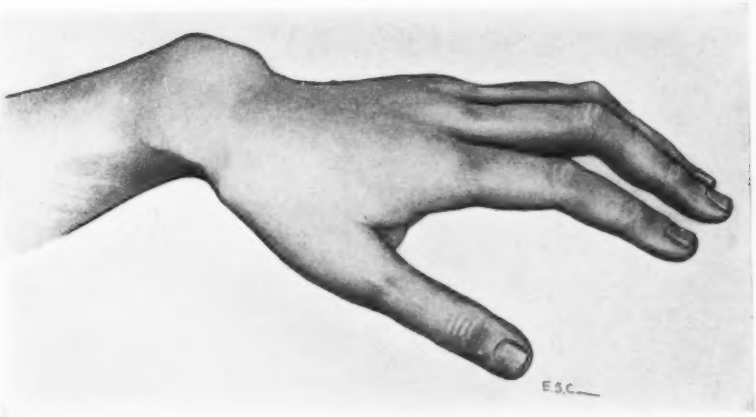
*Personal History.*—She is a well-built, well-nourished young woman. Had scarlet fever when a child. History otherwise negative to date of present trouble.

*Present Trouble—Subjective Symptoms.*—Complains of pain in wrists after they have been exercised and when used to raise heavy weights. Pain began about two years ago at the age of twelve. It was first very mild and noticed only when tired. After some months it became more severe and now causes great annoyance when much motion is required at the wrist-joint or when she is required to do heavy lifting. The pain does not bother her when the wrists are at rest. The wrists are not swollen, but she says that they did swell in the first part of her history. No other complaint except compelled to leave school on account of eyes at the age of fourteen.

At the age of nine years she was compelled to work in the field husking corn and "shocking" bundles of grain, and helping "stack" the grain. All of these occupations required overstrain on the wrists of the child. After these extra strains, she says, the wrists swelled and pained her.

*Objective Symptoms.*—Eyes, heart, lungs, abdomen, and chest wall negative. No rickety rosary, except there is a marked enlargement of the costochondral articulation of the fifth rib. Both tibias bowed outward and the distance between the two calves of the leg at the middle point, when the ankles were together,

FIG. 1.

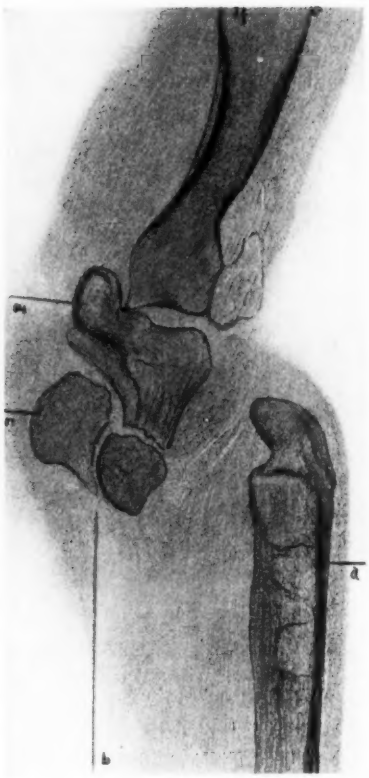


Left hand of Case I in paper.

FIG. 2.

Right hand of Case I in paper.

FIG. 3.




Drawing from a radiograph showing relation of ulna to carpal bones.

FIG. 4.

Radius of left hand in Case II.

was about two inches as reported to me by Dr. Anderson of Stromsburg, Nebraska. Skull bones normal. Pelvis was not examined. Both wrists present a silver-forked deformity. There was no history of fracture. The carpal bones were dislocated forward, and the line of the ulna with the carpal bones presented a marked anterior curve at the point of articulation of the carpal bones with the ulna. The radiocarpal articulation did not present as marked an angle as the ulnocarpal. The radius, however, was markedly bowed forward in the lower third of the diaphysis, and the epiphysis turned very noticeably anteriorly. The styloid process of the ulna was particularly marked. The entire carpal area dislocated forward. There was limitation of extension in both hands, and forcible extension gave great pain. Flexion was normal, as was pronation and supination. Figures 1 and 2 give a fair idea of this condition. Further examination proved negative. We first observed this case two years ago, and saw it again this winter, 1909. There had been no change.

*Diagnosis.*—Spontaneous dislocation of both wrist-joints forward or Madelung's deformity.

CASE II.—Miss M. S., age fifteen years.

*Family History.*—Father and mother well and healthy. No brothers or sisters either living or dead.

*Personal History.*—Had measles and mumps as a child. Neither of these diseases carried with them any complications. Otherwise personal history is negative. No other disease of childhood nor any other form of disease. She is well nourished and of a good social grade. Has always had good care, plenty of good food, and plenty of fresh air. Has lived in the country the early part of her life. Later lived in small villages. Weight 132 pounds, height 5 feet 3 inches, girth measure 28 inches.

Both tibias are bowed outward and her knees do not touch within an inch and a half. There is no serrated edge to the tibia nor is there any other disease of the bone discoverable. The pelvic bones seem to be normal, there is no rosary. Nodules at the end of the ribs, where the ribs join to the sternum, were not found. Her shoulders, elbows, head, and neck are perfectly normal. Heart, lungs, and kidneys are negative. At about the age of seven and a half she began practising on the piano. At about thirteen years of age she noticed that her wrists were slightly deformed and pained her a great deal upon use. Other-

wise she has never noticed that there was any period in which they swelled or showed any signs of acute inflammation. One physician told her that she had symptoms of exophthalmic goitre at or about this time. Personally we were unable to find any evidence of it. There was no goitre, no tachycardia, or no exophthalmus.

At the present time we find both wrists deformed, ulnar side greater than the radial side, representing the characteristic silver-forked deformity in a mild degree. The styloid process of the ulna stands high above the carpal bone, and the end of the ulna is entirely separated from its articulation of the carpal bone. The radius is not so far removed from its articulation, but the carpal bones are removed from the exact position with the radius and are dislocated forward, and the epiphyseal ends of the ulna and radius are separated and the radius moved easily upon the ulna. The carpal bones are undefinable so far as palpation is concerned, the semilunar and scaphoid being entirely removed from definition. Pronation, supination, and flexion are normal. Extension is slightly limited. The hands are apparently as strong as ever, but when used much or examined much pain follows. The ends of the radius and ulna are smaller than normal. The epiphyses apparently are not well developed, as also one is inclined to think from palpation that the carpal bones are lacking in their development.

I am indebted to Dr. Mitchell, of Osceola, Iowa, for this case.

*Etiology.*—We have found 58 cases reported, as follows Abadie,[16] 8 men, 28 women; Poulsen,[17] 2 women; V. Bergmann,[18] 1; Cnopf,[19] 1; Bermeiche, 1; Pels-Leusden,[21] 2; Sauer,[22] 3; Schulze,[23] 1; Volkmann,[24] 2; Putti,[25] 1; Stieda,[26] 1; Bode,[27] 1; Barthès,[28] 2; Lesauvage, 1; Franke,[29] 1; Peckham,[8] 1; Bennett,[1] 1.

Both sides in 31 cases, one side in 26 cases, of these last nine right and 13 left were described as affected side. In two cases a complete description was not found.

These cases have been accounted for by various hypotheses regarding the position of the bones and the articular ligaments. None of these hypotheses have been very definite and each author has given different ideas regarding them.

The two most classical descriptions have been made by Madelung and Delbet,[30] respectively. Madelung collected twelve cases and was able to study one case at autopsy, and described his case quite thoroughly.

He taught that the flexors of the forearm being so much stronger than the extensors pulled the radius backward and held the carpal bones forward, thus producing a partial separation of the scaphoid and semilunar from the radius and ulna.

A primary bone degeneration appeared to Madelung to be indispensable. He did not accept the French idea that trauma or occupation could produce the deformity. Other authors are of similar opinion, as for example, Malfuson,[31] Dekeyser,[32] Gevaert,[33] Kirmisson,[34] and Delbet. Many of them go a little farther and not only show a deformity and degeneration of ends of bone, but also claim it is a symptom of rhachitis. Some authors, as Volkmann and Malfuson, have reported the sudden appearance of the deformity, while Jean and Ardouin[35] speak of it as congenital, without, however, proving their position either by facts or history. Poulsen believed it to be due to a rarefaction osteitis, which he thought to prove from the curving, thickening, and shortening of the bones of the forearm. A great many French authors think the deformity to be due to trauma, which in a certain number of the cases was light and without immediate results, while in others a definite trauma could be determined (Guéry,[36] Lesauvage, Malgaigne, Abadie). Occupations such as shoemakers, typesetters, carpenters, and the like, where the wrist is much used, are given as a cause.

Delbet considers it possible with ossifications of the cartilages of the joint which was described by Bessel-Hagen.[37] In many cases they seem to vary from the Madelung description of "Spontaneous Subluxion."

Barthès describes two forms of the deformity, viz.: (1) "Luxation Progressive of Adolescence;" (2) "Luxation Progressive of Adults."

The spontaneous subluxation of adults as described by Barthès does not appear to answer the question, because the

cases so far observed are nearly all in young people. The author's cases began at twelve years, Franke's case at thirteen years. Of Madelung's twelve cases only two were over twenty-three, and there appears to be some doubt about one as to whether it really was a true case of spontaneous dislocation or a fracture. The remainder of the cases were all under eighteen years.

Pathological changes, as osteomalacia, usually appear later in life, and are slowly progressive, most frequently found in women, affect the shaft of the bone rather than the epiphysis, and the periosteum is thickened and hardened. They more frequently affect the pelvis and are not confined to one bone or joint or two joints. We cannot accept these cases, therefore, as fitting under the symptom complex of the condition known as osteomalacia.

The observed pathological changes may be described briefly as follows: The epiphyseal ends of the bone are irregular, excurvated, and not completely developed. They present the appearance of having been impeded in the completion of the edges and cartilages of the epiphysis. The end of the bone is not so large as normal. It is club-shaped and the processes will not hold the carpal bones in place on the volar side. The same is true of both ulna and radius. The cartilages between the carpal bones and the epiphyseal cartilages are imperfect, ossified in places, and irregular in thickness, and wanting at other points. The volar side in general presents the appearance of a dystrophy (Franke and Poulsen). They also often present hypertrophy of the dorsal edge, as did our case (Weber, Busch, Madelung, Schulze, Bennecke,[38] Franke).

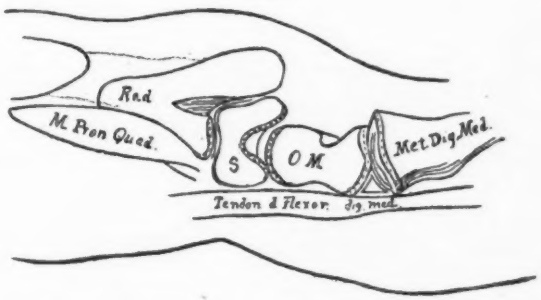
Franke gives a most detailed pathologic description. He concludes that there is not a true dislocation, but only a deviation of direction due to change in the curve of the radius not so much in the direction of the diaphysis as of the epiphysis which is always present. This is also Madelung's idea. There has been, however, constantly found in the later observations a bending of the diaphysis and Stetten agrees with Delbet, that the chief cause of the deformity is the throwing

forward of the articular plane of the radius sufficient in degree to make an apparent dislocation. This was true of our cases. The radio-ulnar articulation is much more widely separated than normal, thus giving artificial and exaggerated movements of the carpal bones and of the hand (Figs. 3 and 4). Our cases did not seem to be as pronounced as Madelung's, as shown by Figs. 5 and 6.

The etiology and pathology of this peculiar deformity are, therefore, not entirely explained. We may, however, from our study of these cases, draw the following conclusions:

First. They occur in people usually of the lower class, many of whom show evidences of rickets.

FIG. 5.




Showing relation of end of radius to carpal and metacarpal.

Second. There is a dystrophy and atrophy in the carpal bones, cartilages, and epiphyses, with an occasional hypertrophy of the dorsal side, and the diaphysis of the radius is curved anteriorly. This corresponds to Delbet's description of the spontaneous subluxations of adolescence.

Third. Radical treatment is only indicated for cosmetic purposes. Symptoms must be controlled by palliative means.

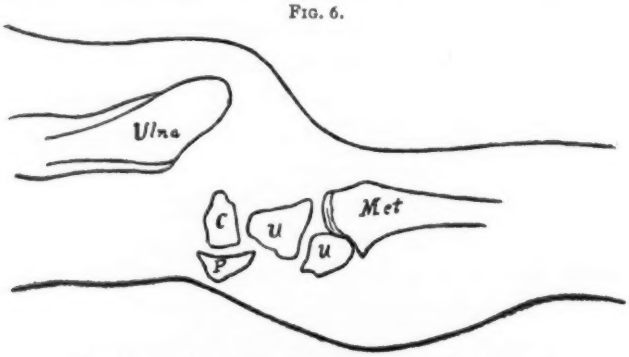
Fourth. Heredity, female sex, and occupations are predisposing factors to this disease.

*Treatment.*—While sometimes osteotomy may be justifiable when the deformity is very great, yet it is not indicated except for cosmetic effects and then it is questionable in its results. Ordinarily plaster casts, splints, etc., are useless. After about

the age of twenty-five all symptomatology disappears. Therefore, palliative treatment is indicated up to that age, or to the disappearance of the symptoms. The treatment must be counterirritation, rest, and overfeeding. Osteotomy may be used after the period of symptoms has passed. In our cases we were not ready to do anything and advised the wrists being let alone.

*Prognosis.*—The prognosis is good as to life. The patient will complain of some pain for several years upon exercise of

FIG. 6.




Showing relation of end of ulna to carpal and metacarpal.

the wrists. Ultimately symptoms will disappear, and the resultant process will be a deformity of the wrist-joints known as the silver-forked deformity.

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# THE CYSTOSCOPIC EXAMINATION IN RENAL TUBERCULOSIS.

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THE object of this paper is two-fold. First, to give the proper diagnostic value to the cystoscopic examination in renal tuberculosis. Second, to picture as accurately as possible the changes in the ureteral orifices in this disease.

Walker in his article, "Tuberculosis of the Bladder," ANNALS OF SURGERY, Feb., Mar., Apr., 1907, indicates the importance of the cystoscopic examination when he says: "There is no sign or symptom, nor is there a definite symptom-complex which indubitably proves the presence of tuberculosis of the bladder. . . . The same frequent and painful micturition and the general bladder distress which accompanies tuberculosis of that organ are also produced to nearly the same degree of intensity by tuberculosis of the kidney, and almost the same symptomatic picture is presented by certain cases of tuberculosis of the prostate."

I can add to this, if the tuberculosis be renal there is no one symptom or class of symptoms which can unquestionably fix the tuberculosis in one side or the other. Pain, kidney enlargement, and so forth, may be wholly on the normal side.

The *relative frequency* of primary involvement of different portions of the genito-urinary tract is of interest and should be kept in mind when a diagnosis is being made. I again quote from Walker. In 279 cases "the kidney seemed to be first implicated in 184; the epididymis in 80; the prostate in 6; the Fallopian tubes in 6; the seminal vesicles

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*Read before the Genito-Urinary Section, Academy of Medicine, Feb. 17, 1909; and before the New York Society, American Urological Association, May, 1909.

in 2; the uterus in 1." That is in about two-thirds of all cases the kidney contains the primary focus as far as the genito-urinary organs are concerned. Also, "clinically primary bladder tuberculosis has been reported often, but as the pathology is being more carefully studied we are becoming convinced that these reports are erroneous." " . . . while primary tuberculosis of the bladder is a possibility, for practical surgical considerations its existence may be disregarded."

*The Pictures.*—At the present time very few adequate pictures of the changes in the ureteral orifices occurring in renal tuberculosis exist. Fenwick, in his classic work, "Ureteric Meatoscopy in Obscure Diseases of the Kidney," 1903, has a few pictures which have been extensively copied.

It is to be regretted that the pictures which I have collected are not photographs. The present photographic cystoscopes are, however, entirely inadequate to produce pictures of much worth. The poor illumination, slow lenses, and very often clouding medium all contribute to the production of poor pictures.

All of the pictures I have made are from sketches made at the time or after the cystoscopic examination. The indirect or prismatic cystoscope of either the Nitze or Otis type has been used in all of the observations. The field of catheterizing cystoscopes is too small to allow good examination of the ureteral orifice.

*Site of Involvement.*—If the kidney contains the primary focus of the disease the cystoscopic examination will show the primary involvement of the bladder around that ureter. If the disease comes from the epididymis and prostate the lesions are first around the vesical neck and trigone. The cystoscopic examination may, however, be very misleading as is shown by Case VI. In this case the cystoscopic picture was typical of a tuberculosis ascending through the prostate to the bladder. Yet in one kidney was the principal if not the primary focus.

*Rigid Ureteral Orifice.*—In most cases of renal tubercu-

losis, whether the process be a recent or an old one, and whether the bladder be involved much or little, the ureteral orifice of the affected side is rigid, non-contracting.

"With normal ureters the contractions of the ureteral orifices indicate that urine is flowing through them; and the contracting of the orifices also indicates contractions of the ureters as a whole. When we turn from normal to diseased ureters the conditions change. When the ureter itself becomes diseased there naturally follows grave disturbance of the ureteral contractions." [1]

In probably all but in certainly six of the cases the ureteral orifice was rigid. In four of these cases the urine from either kidney was obtained by the use of the Luys' separator—the disturbance to the ureteral contractions being less than if the ureteral catheter had been used—and the flow of urine from the diseased side, while irregular, was always interrupted, indicating that definite ureteral contractions took place. This disturbance to the ureteral function is, as far as we can observe, most patent in that portion of the ureter which presents itself to the cystoscopic view—the ureteral orifice—this being rigid when apparently contractions are taking place in other parts of the ureter.

"This might suggest that the vesical portion of the ureter was the most markedly affected of any portion in a so-called descending tuberculosis of the urinary tract. And this would be natural, as the ureter is constricted for a considerable distance where it passes through the bladder wall, and this constricted portion, as well as the portion just above, would form an excellent lodging place for tubercle bacilli."

The other explanation that might be given to this failure of the ureteral orifice to contract at the same time that peristaltic contractions in the ureter as a whole are taking place, is that in normal contractions of the ureters the part of most vigorous contraction is the middle third of the ureter. Lucas says " . . . the middle part of the ureter (comprising at

[1] Barringer: Observations on the Physiology and Pathology of the Ureteral Function, Folio Urologica, Band ii, 1908.

least two-thirds) shows comparatively large contractions . . . The uppermost part of the ureter shows contractions of another type, namely small oscillations . . . The contractions of the lower end of the ureter are generally more frequent and not nearly so large as those . . . at the middle part."

"So if the entire ureter were diseased the contractions would persist longest where, under normal conditions, they were largest and strongest." [2]

The former explanation is, I believe the correct one.

*Relation between the Kidney, Ureter and Bladder Changes.*—There are two conditions so frequently seen in renal tuberculosis as to almost make them peculiar to this disease.

First: When there is entire destruction of one kidney and extensive bladder tuberculosis, we often see the ureteral orifice of the other kidney entirely normal, and obtain entirely normal urine, as regards pus and tubercle bacilli, from this kidney. Such a condition is seen in Case IV.

Second: With partial or complete destruction of one kidney, with a process that must have extended over a period of years, we frequently find with the exception of the ureteral orifice of the affected kidney, the entire bladder normal. Cases I, II, and III illustrate this.

With these two classes of cases the tuberculosis is probably primary in the kidney and both of these conditions would seem in a measure to be dependent upon the frequency of urination so characteristic of renal tuberculosis. The infective material from one kidney does not stay in the bladder for a period of time long enough to affect it. This frequency seems to be a natural prophylaxis against the extension of the tuberculous process both to the bladder and to the other kidney. In contrast with this we comparatively often see bilateral kidney involvement in conditions causing retention of bladder fluid—as ureteral stricture, and prostatic enlargement.

The course of a kidney involvement arising from a bladder

[2] Barringer: *loc. cit.*

infection, is probably as follows: The bladder is involved and with it the bladder portion of the ureter. The bladder portion of the ureter becomes strictured, so causing hindrance to the excretion of urine from that kidney. This causes the kidney to become a point of lowered resistance, a fertile field for the growth of organisms that may be in the blood. The frequency and lack of bladder retention in renal tuberculosis often prevents, I believe, this affection of the bladder portion of the ureter and so the kidney.

The opposite and apparently rarer condition—slight kidney involvement with marked bladder changes, as seen in Case V—would be perhaps explained by the fact that the original focus, as far as the genito-urinary organs are concerned, starts in the bladder or prostate, and there is secondary involvement of the kidney. It is possible, also, that these cases have a certain amount of bladder retention. The cases which I have seen shed but little light upon this question.

*Relation between the Extent of Kidney Involvement and Cystoscopic Changes in the Ureteral Orifice.*—Fenwick has attempted to estimate the extent of kidney involvement by the ureteral changes. I am not at all sure that this can be done. Cases I and II are illustrative of this. In these cases there is no marked thickening of the intravesical portion of the ureter, no marked retraction,—yet in both cases the kidneys were practically destroyed. I can conceive that a ureter that is markedly thickened and retracted might point to an advanced process in the kidney, but even this rule might be fallible. In Case VI there is no change in the ureteral orifice, while the kidney was probably wholly destroyed,—sclerotic, not excreting anything through the ureter.

I believe that grave errors may arise if the cystoscopic picture is alone used to estimate the extent of the kidney lesion.

*Clinical Value of the Cystoscopic Examination.*—If a cloudy medium or a badly inflamed bladder does not interfere with the cystoscopic view we can nearly always determine which kidney is involved. An example of this is shown in

Case VII where the bladder irritability interfered with ureteral catheterism or urinary separation. The simple cystoscopic view determined which kidney was involved and the operation confirmed this.

If on careful examination one ureteral orifice is found to be absolutely normal, contracting and excreting urine, I believe that almost always the kidney corresponding to that ureter has a normal functional capacity and is excreting normal urine—normal as regards pus and tubercle bacilli. Notwithstanding this, in every case of renal tuberculosis there should be a determined attempt to either catheterize the ureters or perform urinary separation. If ureteral catheterism is performed it is probably better to catheterize the normal ureter and obtain the urine from the diseased kidney by means of a catheter in the bladder. There are two reasons for this: First, we wish to find if the presumably well kidney is excreting normal urine. Second, I think that, contrary to what is generally believed, there is less danger of renal infection from the ureteral catheter when a normal ureter is catheterized than when a diseased one is. If both ureters are diseased urinary separation or double ureteral catheterism should be performed.

*The Cases.*—The eight cases [3] which I have chosen show all of the ureteral changes which are described as belonging peculiarly to renal tuberculosis. In most of the cases both ureters are pictured, so allowing a comparison between the diseased and healthy ureteral orifices. In examining the ureters which I have called normal, a number of different types will be seen. They all correspond, however, to one general type. They are not ulcerated, they are neither swollen nor puffy; some of them show slight congestion which is not enough of a departure from the strictly normal to be of any diagnostic significance; some are larger than others but all

[3] A majority of the cases here reported are cases of Drs. C. H. Chetwood and E. L. Keyes, Jr., to whom I am indebted for the use of this valuable material.

FIG. 1.

Case I.—Right ureteral orifice of tuberculous kidney, before nephrectomy

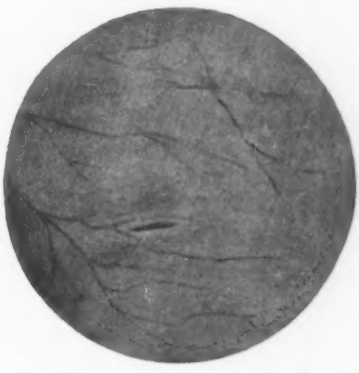
FIG. 2.

Case I.—Right ureteral orifice, two months after nephrectomy.

FIG. 3.

Case II.—Right ureteral orifice.

FIG. 4.



Case II.—Left normal ureteral orifice.

FIG. 5.

Case III.—Right ureteral orifice of tuberculous kidney, before nephrectomy.

FIG. 6.

Case III.—Left normal ureteral orifice, before nephrectomy.

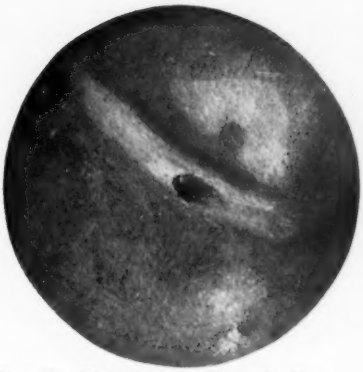
FIG. 7.

Case IV.—Right ureteral orifice of tuberculous kidney.

FIG. 8.

Case IV.—Left normal ureteral orifice.

FIG. 9.

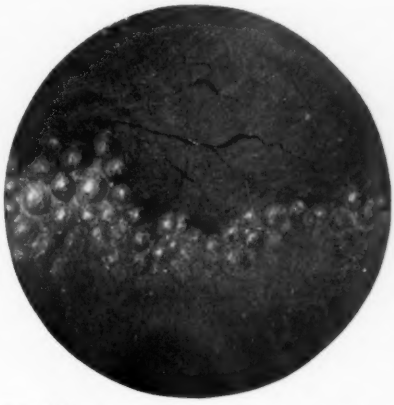


Case V.—Right ureter. Ureter itself apparently normal, contracting.

FIG. 10.

Case V.—Left diseased ureter. Rigid, ulcerated, golf hole.

FIG. 11.



Case VI.—Intravesical portion of prostate; nodular, covered with pink tubercles.

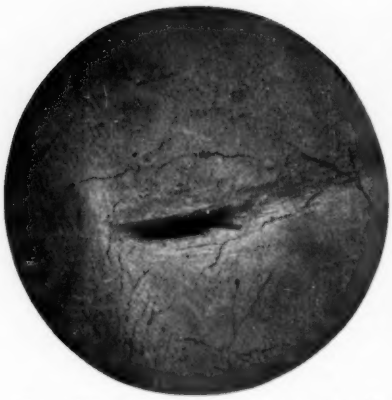
FIG. 12.

Case VI.—Left ureter. Kidney normal; pink tubercles around trigone.

FIG. 13.

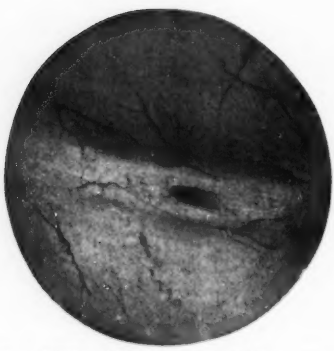
Case VII.—Left ureter, before nephrectomy. Kidney showed caseous areas. Bullous œdema around ureter.

FIG. 14.



Case VII.—Left ureter, one month after nephrectomy. Bullæ entirely gone.

FIG. 15.



Case VIII.—Right ureteral orifice. Normal, contracting.

FIG. 16.

Case VIII.—Left ureteral orifice. Apparently rigid; otherwise normal. Kidney was tuberculous.

within the bounds of the normal. After the study of a series of cases with an adequate cystoscope (I have used exclusively the prismatic) it is not difficult to recognize and classify the variations of a normal ureter.

Cases I, II, III and IV show changes in the ureter which are practically only seen in renal tuberculosis. Case VI showed no ureter changes but a bladder tuberculosis, while the main lesion was in one kidney. Cases VII and VIII showed changes which may occur in conditions other than renal tuberculosis. All of the cases, with one exception (Case VI), have been proved either by operation or the finding of tubercle bacilli in the urine to be tuberculous. Six of the cases have been operated upon. In five cases the urine from either kidney has been obtained by ureteral catheterism or urinary separation. All of the cases have been cystoscoped before operation and two after operation,—Case I two months after nephrectomy, Case VII one month after nephrectomy.

### REPORT OF CASES.

CASE I.—Miss O'H., 26 years of age, single, History of frequent and burning urination for the past four months. Urine has been thick and turbid for the past week. Has lost no weight. Right kidney palpable, enlarged and tender.

*Cystoscopic Examination.*—Bladder capacity, 175 c.c. Bladder urine cloudy, but bladder washings returned clear after two irrigations. Right ureteral orifice (Fig. 1) surrounded by red granulations, with a few submucous hemorrhages, noncontracting; no ulcerations. Left ureteral orifice normal, contracting regularly, clear urine issuing. The rest of the bladder entirely normal.

#### ANALYSIS.

Separation of the Urines with the Luys' Separator.

| | Right urine. | Left urine. |
|---|---|---|
| Quantity ..... | 3 c.c. in 15 min. | 8 c.c. in 15 min. |
| Color ..... | Colorless | Yellow. |
| Reaction ..... | *Neutral.* | *Acid.* |
| Appearance ..... | Turbid. | Clear. |
| Albumin ..... | Trace. | Marked trace. |
| Urea ..... | 1 gram to litre. | 25 grams to litre. |

MICROSCOPICAL.

| | | |
|---|---|---|
| Blood | ..... | Moderate No. fresh. |
| Pus | Many pus-cells. | Rare leucocyte. |
| Bacteria | *Tubercle bacilli.* | None. |

The urinary separation was exact, even the reaction of the two sides being different. The total urea excreted by either side indicated that the right kidney was practically non-functionating. At operation I found the right kidney to be composed of large abscess cavities, practically destroyed; it was removed.

Two months after nephrectomy the cystoscopic examination of the right ureteral orifice (Fig. 2) showed that the red granulations had entirely disappeared, and normal mucous membrane surrounded the closed, rigid ureteral mouth, indicating involution of the tuberculous process in the urinary system.

*Remarks.*—These red granulations surrounding a ureteral orifice are seen only in renal tuberculosis. From neither the history, the physical signs nor the cystoscopic examination could any idea of the extent of the process be gained. Examination of the urine from either kidney gave the only accurate knowledge of the extent of the process.

CASE II.—Case of Dr. Beck, New Haven. History: Patient diagnosed as having hip disease (some months before seen). Had pain in right lumbar and inguinal regions. Has a large cold abscess over right iliac crest. Urine contained pus and tubercle bacilli.

*Cystoscopy.*—Bladder capacity 150 c.c. Urine cloudy. Right ureteral orifice (Fig. 3): Retracted to right; much thickened. Orifice small, irregular; surrounded by an area of pink granulations with a few conglomerate tubercles. Left ureteral orifice (Fig. 4): Normally placed and normal in appearance. The rest of the bladder entirely normal.

Ureteral catheterism was not performed because of lack of time.

*Operation.*—Dr. Beck and I removed a right tuberculous kidney, almost completely destroyed. The patient is convalescing, now some weeks post-nephrectomy.

*Remarks.*—This picture could not be mistaken for anything else than renal tuberculosis. The diagnosis could be made without finding tubercle bacilli in the urine. As a rule this cystoscopic picture is seen with an old process with extensive kidney destruction.

CASE III.—Mr. J. C., 35 years, married. Gonorrhœa four years ago. One and a half months later could not urinate; catheterized. Since then bladder irritation. Weakness of back; no especial pain in kidney regions. Has lost 15 to 20 pounds in last year. Night sweats. Now urinates daily every 2 to 3 hours; at night seven or eight times.

*Cystoscopic Examination.*—Bladder urine very cloudy; bladder washed clean after eight to ten irrigations. Moderate congestion and cystitis of base of the bladder. Right ureteral orifice (Fig. 5): Open; rigid; surrounded by slight congestion. Small ulceration at one angle. Left ureteral orifice (Fig. 6): Slightly congested, contracting regularly every ten to twelve seconds. Urine issuing.

*Ureteral Catheterism.*—Urine ran irregularly from right catheter and regularly from left.

ANALYSIS.

| | Right urine. | Left urine. |
|---|---|---|
| Quantity ..... | 4 c.c. in 10 min. | 5½ c.c. in 10 min. |
| Color ..... | Light yellow. | Amber. |
| Appearance .... | Cloudy. | Slightly cloudy. |
| Precipitate ..... | Moderate. | Slight. |
| Reaction ..... | Faintly acid. | Acid. |
| Albumin ..... | Heavy trace. | Slight trace. |
| Urea ..... | 1 gram to litre. | 16 grams to litre. |

MICROSCOPICAL.

| | | |
|---|---|---|
| Red blood-cells.. | Rare. | Rare. |
| Pus-cells ..... | Many. | None; rare leucocyte. |
| Bacteria ..... | *Tubercle bacilli.* | None. |

The "total urea" of the normal kidney was twenty-two times as much as that of the diseased, indicating practically an entire lack of kidney function of the diseased kidney.

One year later the patient returned with a left tuberculous epididymitis. Separation of the urines at that time with the

Luys' separator gave practically the same results as the ureteral catheterism with the exception that the process in the right kidney had extended, the fluid excreted from the right kidney containing not even a trace of urea. Examination of the nephrectomized kidney showed complete destruction of kidney tissue, with large cavity formation. The patient died on the second day after nephrectomy from heart failure. He passed a sufficient amount of urine up to time of his death.

*Remarks.*—Again the cystoscopic picture gave no index of the extent of kidney involvement. The cystoscopic picture of the diseased ureter is but very rarely seen with conditions other than renal tuberculosis.

CASE IV.—Hazel T., 14 years old. History of increased frequency of urination and cloudy urine for the past eighteen months. Right kidney tender on deep pressure.

*Cystoscopic Examination.*—Bladder capacity 50 c.c. Urine cloudy. Right ureteral orifice (Fig. 7): Enlarged, thickened and rigid; ulcerated in places. Left ureteral orifice (Fig. 8): Normal and contracting. Base of bladder congested and the site of chronic cystitis in places.

ANALYSIS.

Separation of the Urines with the Luys' Separator.

| | Right urine. | Left urine. |
|---|---|---|
| Quantity ..... | 4 c.c. in 12 min. | 20 c.c. in 12 min. |
| Color ..... | Yellow. | Yellow. |
| Appearance .... | Cloudy. | Clear. |
| Albumin and urea | Not taken. | Not taken. |
| MICROSCOPICAL. | | |
| Blood ..... | Few red blood-cells. | Many red blood-cells, (traumatic). |
| Pus ..... | Many blood shadows. | No pus; few leucocytes. |
| Epithelium ..... | Much pus. | Oc. renal; oc. vesical. |
| Casts ..... | Much renal. Oc. hyaline and granular. | 1 epithelial; 2 hyaline. |
| Bacteria ..... | Many tubercle bacilli. | No tubercle bacilli. |

*Remarks.*—Renal tuberculosis is the only condition which gives this cystoscopic picture. Enlarged, thickened, rigid, ulcerated ureteral orifice. The left kidney excreted practically normal urine and the left ureteral orifice was normal notwithstanding the surrounding cystitis of the bladder.

CASE V.—William A., 33 years, married. Case of Dr. C. H. Chetwood. Chief complaint at present, pain in right kidney region, and frequent day (15 times) and night (20 times) urination.

*Cystoscopic Examination.*—Bladder capacity 30 c.c. Urine cloudy; bladder irrigations returned clear after 6 to 7 washings, but rapidly reclouded. Bladder ulcerated; many submucous hemorrhages. Ureters not seen. Urinary separation failed. The separator could not be introduced into the bladder because of the rigid bladder neck.

Phloridzin test: Fifteen minims of a 1 per cent. phloridzin solution (in 33 per cent. alcohol) injected in arm. Suggestion of sugar at 40 minims post-injection; strongly positive at 50 minims.

*Second Cystoscopic Examination* (Two days after first failure).—Right ureter (Fig. 9): Small, normally placed, contracting; surrounded by submucous hemorrhages. Apparently fairly normal. Left ureter (Fig. 10): Golf hole, rigid; surrounded by ulcerations. Entire base of bladder covered with small submucous hemorrhages and ulcerated areas.

*Nephrectomy.*—Left, by Dr. Chetwood. Specimen showed tuberculous kidney with abscesses. Much normal kidney tissue in specimen.

Phloridzin test two weeks after operation: Suggestion of sugar 25 minims post-injection; positive at 30 minims.

Some months after operation the patient died, probably from a general tuberculosis.

*Remarks.*—The right ureteral orifice did not look entirely normal. The left ureter was, however, so markedly diseased that it was deemed advisable to explore the left kidney. Finding abscesses in this it was removed. Unfortunately the case was not cystoscoped after the operation. The better excretion of phloridzin after operation would seem to indicate that the remaining kidney was not diseased.

CASE VI (Case of Dr. C. H. Chetwood).—T. F. B., aged 46. Hæmaturia four, three, and two years ago. Patient is said to have passed a calculus two years ago. In 1894 left testicle and epididymis removed for alleged tuberculosis. Chief complaint is pain in right side which is aggravated by movements of the body; and marked urgency and frequency, but no pain.

*Cystoscopic Examination.*—Bladder capacity 200 c.c. Urine cloudy. Bladder fluid returned clear after six to seven washings and remained clear. All over the base of the bladder and especially marked near the left ureteral orifice are irregular patches of small pink tubercles between

which is normal mucous membrane. Right ureteral orifice: Normal. Left ureteral orifice: Normal contracting (see Fig. 12). Prostate: The intravesical portion of the prostate is nodular and covered with the same pink tubercles (Fig. 11).

Urinary separation (with the Luys' separator):

The separator was introduced without pain and remained in place thirty-six minutes. In that time three-fourth c.c. flowed from right side and 20 c.c. from the left.

ANALYSIS.

| | Right urine. | Left urine. |
|---|---|---|
| Quantity..... | Three-fourths c.c. | 20 c.c. |
| Color..... | White. | Bluish (from ind.-carmin) |
| Appearance.... | Clear. | Slightly flocculent. |
| Albumin..... | Negative. | Trace. |
| Sugar..... | Negative. | Negative. |
| Urea..... | Negative. | 18 grams to litre. |

Indigo Carmin Test: Some minutes before the introduction of separator, 4 c.c. of a three per cent. solution of indigo carmin injected into buttock with following results: Right side.—No blue up to 41 minutes. Left side.—Blue in 13 to 14 minutes post-injection.

*Remarks.*—Notwithstanding the fact that no tubercle bacilli were found in the urine, the diagnosis of urinary tuberculosis was unquestioned because of the history and the cystoscopic picture. Both ureters were normal; but, as the affected right kidney was excreting nothing into the bladder, this is natural. This case well demonstrates the danger of making a diagnosis by means of the cystoscopic examination alone as suggested by Fenwick.

CASE VII.—H. P. E., 36 years old. (Case of Dr. C. H. Chetwood.) Hæmaturia, once many years ago. Swollen right testicle 11 years ago; left epididymitis six weeks ago, which left the epididymis swollen and hard. Principal complaint, pain in left lumbocostal region. Urination normal.

*Cystoscopic Examination.*—Urine cloudy; bladder fluid returned clear after five to six irrigations but rapidly reclouded. Right ureteral orifice: Normal, contracting regularly. Left ureteral orifice (Fig. 13): Surrounded by small pink nodules, either bullæ or tubercles; rigid non-contracting. There were a few small patches of cystitis of the bladder base.

Ureteral catheterism or urinary separation was not attempted because of the extreme irritability of the bladder.

The urinary examination showed pus; slight trace of albumin, but no tubercle bacilli on two examinations.

*Diagnosis.*—Pyuria of left kidney origin, probably tuberculous.

*Operation* by Dr. Chetwood. The kidney was found to have a number of abscess and large caseous foci in the lower pole.

*Cystoscopic Examination* (One month after nephrectomy).—Bladder urine slightly cloudy; bladder washed clear in two to three irrigations. Right ureter normal, contracting. Left ureter (Fig. 14), rigid, closed; bullæ around the orifice have entirely disappeared. Bladder otherwise normal.

*Remarks.*—The changes around the ureter were probably not due to the formation of tubercles, as these would probably not disappear in one month. Rather they were bullous œdema. This bullous œdema is not all characteristic of tuberculosis. I have seen it with stone in the lower portion of the ureter, cystitis, pyogenic infections of the kidney, etc. Again we have slight bladder change with marked kidney destruction.

CASE VIII (Case of Dr. E. L. Keyes, Jr.).—A. G., male, 34 years old. Seven years ago frequent and painful urination. Four years ago pain in left kidney. One year later abscess in right kidney region; opened.

*Cystoscopic Examination.*—Urine cloudy. Bladder irrigations returned clear after four to five washings and slowly reclouded. Right ureteral orifice (Fig. 15), contracting regularly and frequently; apparently clear urine coming forth. Left ureteral orifice (Fig. 16) apparently rigid, and pus coming forth. No ulcerations, no changes in the mucous membrane.

ANALYSIS.

Ureteral Catheterism.

| | Right urine. | Left urine. |
|---|---|---|
| Quantity ..... | 4 c.c. | 5 c.c. |
| Color ..... | Red. | Whitish. |
| Appearance .... | Slightly cloudy. | More cloudy. |
| Albumin ..... | Marked trace. | More marked trace. |
| Urea ..... | 26 Gm. to litre. | 20 Gm. to litre. |

MICROSCOPICAL.

| | | |
|---|---|---|
| Red blood-cells . | Number (traumatic). | Rare. |
| Pus ..... | None, few leucocytes. | Much pus. |
| Epithelium ..... | Rare renal. | Kidney cells. |
| Bacteria ..... | No tubercle bacilli. | No tubercle bacilli. |

*Nephrectomy* (by Dr. Keyes).—A kidney was removed with a tuberculous focus at the upper pole which was connected with the pelvis by a very small sinus.

*Remarks.*—It is rather unusual to see such slight ureteral changes when the kidney process has extended over a number of years.

SUMMARY.

1. By means of the cystoscopic examination we can almost always tell which kidney is affected in renal tuberculosis. The exception to this is when the tuberculous process is shut off from the kidney pelvis, or when the kidney excretes nothing at all through the ureter.

2. The extent of the lesion cannot be accurately determined by the cystoscopic examination, which must in all cases be supplemented by ureteral catheterism or urinary separation.

3. Aside from its rigidity the most typical changes in the ureteral orifice are, (*a*) tubercles around the orifice; (*b*) red granulations; (*c*) enlarged, thickened and ulcerated orifice.

4. A ureter which looks normal and which is contracting and excreting urine, indicates in the large majority of cases a kidney which is excreting normal urine as regards pus and tubercle bacilli, and has a normal functional capacity.

5. In some cases the diagnosis of tuberculosis can be made by means of the cystoscopy alone. This is of considerable value when tubercle bacilli are not found in the urine.

# CYSTIC DISEASE OF THE BREAST.*

BY WILLIAM J. TAYLOR, M.D.,

OF PHILADELPHIA.

DURING the past few years I have had under my care 26 cases of disease of the female breast in which some form of cystic degeneration had occurred, and one case of cystic disease in a male breast. During the same period I have had 28 cases of primary carcinoma of the breast.

I have not included in this list certain other cases of disease of the breast, such as fibroma, adenofibroma, and sarcoma, nor some cases which I have seen in the practice of other surgeons and of whom I have no definite records.

Of these 26 cases of cystic disease, 13, or just 50 per cent., had undergone some form of carcinomatous degeneration at the time of operation. It will therefore be seen that of the whole number there were nearly as many cases of cystic disease as of primary carcinoma in the proportion of 26 to 28, and that of these 26 cases one-half showed unmistakable evidences of carcinomatous degeneration. Several of these had had cystic disease for many years, in one instance for 17 years, and finally at operation cancerous changes were found.

This patient, a trained nurse, was under my personal observation for six years, but would not listen to the question of operation. At times the breast would show distinct evidence of enlargement, and cysts could be easily palpated, while a short time afterwards all evidence of disease would disappear and the breast feel perfectly normal. This was so unusual that for two years, from 1902 to 1904, I made frequent diagrams for record which show that a tumor could be felt in one portion of the breast at one visit and entirely disappear at the next, while later it would reappear in a totally new position. This patient first noticed the breast swollen or lumpy in 1886, with

* Read before the Philadelphia Academy of Surgery, March 7, 1910.

various degrees of pain and discomfort for two years, when all signs of trouble ceased, and it was not until 1899, or eleven years afterwards, that she again had trouble with it. Again it became normal and remained so for three years, or until 1902. During 1902 and 1903, as I have just stated, she was under my personal observation, and it was then that the diagrams were made. Finally, in 1904, a distinct mass in the upper outer quadrant became pronounced, fairly dense but elastic, and the patient consented to operation.

Microscopic examination showed a cystic breast, and the wall of the largest cyst was carcinomatous. The report was cystadenofibroma with beginning hard adenocarcinoma.

Very fortunately she has had no recurrence and is well to-day, six years since the breast was removed.

Of the 13 cases in which carcinomatous degeneration had occurred, six had cystic disease of both breasts, and a double operation was performed. In five of these one breast was found to be carcinomatous and the other simple cystic disease, while in one case both breasts were carcinomatous. In two of these cases, an aunt and a niece, both breasts were cystic, one of each being carcinomatous, and there had been ten members of their immediate family afflicted with carcinoma in some of its various forms.

My object in presenting this short paper is to emphasize the fact that in my personal experience of 26 cases of cystic disease of the breast, 13 or just 50 per cent., were carcinomatous at the time of operation. I wish to put on record in the strongest possible language that can be used, my belief that all forms of this disease are dangerous, and that certainly one-half of such breasts will sooner or later undergo degenerative changes which will threaten the life of the patient. I know that many writers speak as though cystic disease was a trivial affection and one which does not demand prompt surgical intervention, but this does not agree with my own experience. When a cystic breast which has remained quiescent for a period takes on renewed activity, it is almost certain to be carcinomatous.

*Treatment.*—At one time I was quite favorable to Dr. Warren's method of operating, by which the gland is turned up on the chest and a wedge-shaped piece taken out which should include the cysts. Certainly, in a few well-selected cases, where the cysts are few and the period of the disease early, this is sufficient. It permits of a thorough examination of the breast, and does not produce the mutilation which a total amputation of the breast entails. Many young women will consent to this who would absolutely refuse the more radical procedure. With increasing experience, however, and after careful study of the history of my cases, I am more and more disinclined to accept this method as in any way adequate to insure the safety of the woman who is so unfortunate as to possess a cystic breast. I now make it a rule never to perform this without having the permission of the patient to do a more radical and thorough operation if I find the disease more extensive than I had originally believed it to be.

In operating, the whole gland should be removed with a wide area of skin, all glandular and fatty tissue removed from the axilla, and the fascia of the pectoral muscle taken away. The muscle itself I do not as a rule remove unless the tissues of the breast appear macroscopically uncertain.

I am so confident of the value of the X-rays in destroying carcinomatous cells and in at least retarding a recurrence of the disease, that I believe they should always be used as a prophylactic measure. Administration by a competent man twice or three times a week until ten or twelve treatments have been given, this to be repeated in three months, and again in nine months, adds materially to the safety of the patient.

When malignant changes have occurred, I believe the use of the X-rays is imperative, and their use should never be omitted. In two of the cases in my series local recurrences took place several times, the primary operation having been performed by other surgeons, probably being insufficient in extent, and finally Beatson's operation, of ovariotomy, was done. One of these patients lived for 13 years. The other, upon whom I operated in September, 1901, is alive and per-

fectly well to-day. In this latter case the X-rays have been employed twice a year, while in the former case they were not.

I have purposely not gone into the pathological histories of these cases, but confined myself to the clinical aspect of the disease, because Dr. John Speese, in the paper which he read at the meeting of this Academy in November, 1909, has covered the ground admirably and fully.

# TRANSACTIONS
OF THE
# NEW YORK SURGICAL SOCIETY.

*Stated Meeting, March 9, 1910.*

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

## NEURALGIA OF THE SECOND DIVISION OF THE FIFTH NERVE: KOCHER'S OPERATION.

DR. A. V. MOSCHCOWITZ presented a man, fifty-two years old, who had been under his observation since 1908. He gave the usual history and symptomatology of these cases. In June and July, 1907, he was under the care of Dr. Otto G. T. Kiliani and received four injections of alcohol without obtaining any relief whatsoever.

The patient was first operated on by Dr. Moschcowitz on February 25, 1908, the operation consisting of a division of the first and second branches of the fifth nerve at their exit from the supra-orbital and infra-orbital foramina, these openings being then plugged with silver buttons. Following this operation there was a cessation of the pain in the integumentary distribution of the nerves, but it had no effect upon the pain in the palatal and superior dental nerves. A few months later the third division of the nerve also became involved. As the patient refused a major operation, he was again operated on under local anæsthesia on February 5, 1909, the inferior dental nerve being exposed and divided at its exit from the mental foramen, and the foramen plugged with a silver button.

As was to be expected, the patient again experienced relief in the integumentary distribution of the nerve only, and he was subsequently re-admitted to the hospital, seeking relief for the pain, which he now referred particularly to the nerve originally involved, *i.e.*, the second division. Kocher's operation was done on October 25, 1909, and since then the patient had been entirely relieved of his pain. The time that had elapsed since the operation was of course too short to pronounce it a cure.

Dr. Moschcowitz said this was the first time he had performed

Kocher's operation, but he was very much impressed with the beautiful exposure it gave and the ease with which he was able to extract the entire nerve.

TRIGEMINAL NEURALGIA: HARTLEY-KRAUSE OPERATION.

DR. MOSCHCOWITZ also showed this case. The patient was a married woman, fifty-eight years old, who had been referred to him a little over three years ago with the typical symptoms of trigeminal neuralgia. In this case the pain was so exquisitely confined to the integumentary distribution of all three divisions that he looked upon it as an ideal one for a peripheral operation. This was done early in 1907, the three branches of the nerve being cut and the foramina plugged. This gave the patient complete relief for over a year. Then the pain recurred in the distribution of the nerve proximally to the silver plugs, and as the involvement was so extensive, the speaker said he advised an intracranial operation, his intention being to divide the sensory root only.

In connection with the operation itself, the following interesting points were observed: When the operation was commenced, the patient's pulse was 104 and the blood-pressure 155. There was absolutely no hemorrhage to speak of, yet the blood-pressure sank very rapidly, falling to 110 in seventeen minutes and to 85 in twenty-six minutes. This action of the blood-pressure almost decided him to complete the operation at a second sitting, but as the pulse continued of excellent quality, he completed the operation at once, but abandoned his original intention of dividing the sensory root only, and substituted for it an extirpation of the Gasserian ganglion, which, with the exposure he then had, was evidently of easier execution.

The patient was out of bed on the day following the operation, and made practically an uneventful recovery. The eye was protected by a watch-glass, and there was no resulting irritation of the cornea. Anæsthesia was complete, and there has been entire relief from pain up to the present time.

DR. ELLSWORTH ELIOT said he had had a single experience with the Kocher operation in a case of extreme neuralgia of the superior maxillary nerve. The patient was free from pain for a number of months; then it recurred, although it was not so intense as prior to the operation. A resection of the ganglion was advised, but the patient declined.

## DUODENAL FISTULA FOLLOWING NEPHRECTOMY FOR STONE.

Dr. James M. Hitzrot presented a married woman, forty-three years old, who was admitted to Bellevue Hospital on June 1, 1908, complaining of pains in the right lumbar region which had been present for the past three years. For the past six months she had been confined to bed with chills and fever; she had lost some weight, and her feet became swollen when she got out of bed. At varying intervals the urine had contained blood. There had been no urinary frequency; no colic; no radiation of the pain. On the day prior to her admission the pain became extreme in the right side, and she had a high fever, with chills.

Upon admission, examination showed a large perinephritic abscess, which was pointing near its centre. The patient was anæmic, and both feet were slightly swollen. Her temperature was 101; pulse, 120; respirations, 24. The urine contained numerous pus cells.

Under local anæsthesia the perinephritic abscess was opened, and more than a pint of pus was evacuated. No stones could be felt in the wound. The patient refused further treatment at the time, and left the hospital with a small discharging sinus. The pus proved sterile on culture.

The patient was re-admitted to Bellevue Hospital on July 26, 1909, complaining of a discharge from the sinus in her right side, which she said had lasted for two weeks. Since leaving the hospital she had had recurring attacks of aching pain in the right side, which became more severe just before the wound opened and discharged; since then she had felt better. Her general condition had slowly improved. Her urine had occasionally contained blood. An examination showed a discharge of pus in the region of the old scar, and a probe introduced into the sinus met with a hard, gritty resistance. The kidney itself was not palpable. There was some œdema of the feet and legs, but the patient's condition otherwise was fair. The urine had a specific gravity of 1018; it contained albumin and leucocytes, and granular and hyaline casts; no blood. A blood count showed 16,000 white cells, with 72 per cent. of polynuclears. A cystoscopic examination made by Dr. V. C. Thorne showed pus coming from the right ureter, the mouth of which was injected and swollen. The left ureter was normal, and the urine issuing from it was apparently clear.

*Operation,* July 29, 1909.—The right kidney was exposed through an incision extending from the twelfth rib to the crest of the ilium, and was removed with considerable difficulty, on account of the dense perirenal adhesions. The perirenal scar tissue contained three or four free calculi. The pedicle was clamped, and the rather free oozing was controlled by gauze packing. This was removed on the fourth day, and the clamps were taken off on the following day. On the night of the sixth day there was a copious discharge from the wound; this continued, and on the following morning there was escape of clotted milk from the wound. The patient complained that the discharge burned her skin. It was acid and bile was found present in one test. There was no vomiting. Milk given by the mouth promptly appeared in the wound in the form of clots, and methylene blue, given by capsule *per os,* appeared in the wound within an hour after its ingestion (40 min., 35 min., 25 min., 60 min.).

Frequent saline irrigations were used to cleanse the wound and it was dressed and packed at regular intervals. The discharge began to grow less on the twelfth day, and the wound was then packed with gauze soaked in a one per cent. balsam of Peru in vaseline. On the twenty-second day methylene blue taken by the mouth no longer appeared in the wound, and the sinus healed completely after two months. Since then the patient had steadily improved.

In connection with this case, Dr. Hitzrot exhibited an X-ray picture taken prior to the nephrectomy, which showed the presence of seven stones in the kidney. The pathological report, furnished by Dr. Norris, showed that the kidney structure was almost completely destroyed, with only small areas of kidney tissue remaining in the dense scar tissue. A large, branching stone completely filled the pelvis and calices of the kidney.

Dr. Eliot asked whether the patient lost flesh during the interval that elapsed prior to the closure of the duodenal fistula, and also whether a gastro-enterostomy was suggested to hasten its closure. The speaker said that in one case of duodenal fistula that came under his observation, the lesion was the result of a perforation of an ulcer associated with an extensive abscess involving at least three-quarters of the peritoneal cavity which had been opened and drained. A duodenal fistula developed, and within a week or ten days there was a free discharge of duodenal

contents. Associated with this there was a slowly progressive loss of strength which finally precluded operative interference, and the patient died of exhaustion. In that instance, Dr. Eliot said, he afterwards regretted that he did not make an attempt to save the patient by an early gastro-enterostomy, although at the time it seemed to be contraindicated by the extensive suppurative peritonitis. Efforts were made to close the opening in the duodenum by pressure, as Dr. Hitzrot had done, but without success.

DR. HITZROT, replying to Dr. Eliot, said that Dr. John Rogers had suggested a gastro-enterostomy, but the patient was doing so well by the packing method that an operation was found unnecessary. She was fed on milk and milk sugar by rectum, and did not lose flesh materially during the 22 days that the fistula remained open.

## RESULT FOLLOWING EXCISION OF FRACTURED CARPAL SCAPHOID AND DISLOCATED SEMILUNAR.

DR. HITZROT showed this case, together with X-ray pictures. The patient was a man, twenty-three years old, an acrobat, who was admitted to the New York Hospital accident ward about December 1, 1909, with the history of having fallen 10 feet on the previous day, striking the cement floor. As he fell, his left hand, which was in his overcoat pocket, received the brunt of the fall. He complained of a great deal of pain in the left wrist and was unable to bend it.

When Dr. Hitzrot first saw the patient, about three weeks later, the wrist was swollen. There was no active nor passive motion, and attempts at motion were painful. Pressure on the snuff-box was painful, as was pressure between the extensor tendons of the thumb and fingers. On the palmar surface, between the palmaris and flexor radialis tendons, there was a hard, bony mass which could not be moved by pressure; over the ulnar styloid there was some tenderness. An X-ray was taken, which showed a displaced semilunar, fracture of the scaphoid and of the styloid process of the ulna.

The patient entered the hospital in Dr. Alexander B. Johnson's service, on January 6, 1910, and on the following day Dr. Hitzrot made an incision two inches long from the base of the palm midway between the flexor carpi radialis and palmaris. The anterior annular ligament was then cut, and the tendons and

nerve drawn to the ulnar side of the hand. This exposed the displaced semilunar, with a small fragment of bone attached to its ulnar side. As the semilunar could not be replaced, it was removed, together with the proximal fragment of the scaphoid and the small fragment already mentioned, which after removal was found to have come from the anterior surface (at its edge) of the radius. The annular ligament was closed with catgut and the wound was closed without drainage.

The patient's recovery was uneventful. Baking the wrist was resorted to at the end of the first week, with massage and active motion. Dr. Irving D. Steinhardt took the patient to the Vanderbilt Clinic, where motion was continued by the use of the mechanical exerciser for that purpose. The wrist could now be moved, with but little limitation, in all directions. There was no pain, excepting over the ulnar styloid and in dorsal extension when lifting.

The patient stated at the meeting that he could now catch his partner on his extended hand without any pain and support him there.

## INTESTINAL DIVERTICULITIS.

Dr. John A. Hartwell presented the gross specimens, microscopical sections and lantern slides from 19 cases of intestinal diverticulitis collected by Dr. R. Cecil and himself. As the result of their study of these, they gave the following summary and conclusions:

All of the small intestinal diverticula were in close relation with the mesenteric line; none of those in the large intestine was so placed, the greatest number, eight cases, being found between a lateral tænia and the mesentery. Only one was found in the convex border of the intestine. In only one case was there any evidence that a venous congestion in the inferior mesenteric veins had been present during life while in eleven this was absent; in the remaining six, no information on this point was obtainable. This was in direct opposition to the finding of Grasser.

Evidence of the muscular coats being present in the wall of the diverticulum was found in every case except two. In some it was much thinned out, the large diverticula showing this thinning most markedly. This might be taken as proof that in their beginning all diverticula were of the true type, and that with their growth they took on the characteristics of the false type.

Summary of reported cases: Four cases showed symptoms for which they were operated. Three suffered from chronic symptoms, and all were cured by operation. One suffered from acute obstruction and was cured by operation. Eight specimens were obtained from autopsies on persons dying from causes not connected with the diverticula, and in none of them had any symptoms relative to this condition ever been present. The remaining six specimens were found in the museums, and no clinical nor post-mortem data were obtainable.

Of 13 cases in which the sex was given, 10 were females and 3 were males. The 2 youngest cases were six and seven years old, respectively. Three were under thirty years of age, and 6 were over fifty. The ages of those giving clinical symptoms were between twenty-two and forty-three, thus demonstrating that neither the diverticulum nor its inflammation is solely a disease of advanced life. Three cases out of 5 examined were found in infants. The least number of diverticula found in a given case was one, and the most was 33, with an average of about 10. In 7 cases the lesions involved the descending colon or the sigmoid, or both. Three involved the ascending colon or the cæcum, 2 the transverse colon, 2 were said to have involved the "colon," the particular section of the gut not being given, 4 involved the small intestine, 1 of which was in the duodenum, and 1 involved the wall of a Meckel's diverticulum.

Conclusions: (1) Diverticulum of the intestine is a common condition. (2) The large bowel is the most frequent site, particularly the descending colon and the sigmoid. Here their inflammation, producing clinical symptoms, is also common. (3) Children and young adults are subject both to the diverticulum and to the secondary changes in it. (4) A congenital defect in the intestinal wall of the colon could be proven, and this is the most important factor, etiologically, in the formation of diverticula of the large intestine, at least. (5) All diverticula are probably true in their incipiency. The false characteristics are the result of their growth. (6) Diverticula undergo the same pathological changes as the appendix vermiformis, and give rise to much the same general symptoms. These pathological changes are not uncommon.

Dr. John F. Erdmann said that a few weeks ago he operated on a man, forty-three years old, whose history dated back

four years, the symptoms pointing to a condition of chronic indigestion. Operation revealed one large diverticulum, about the size of a small hen's egg, and numerous small ones. This section of the sigmoid was removed with considerable difficulty, as it had turned over to the right side and was densely adherent to the mesentery of the small intestine. The patient made a good recovery.

In another case, which was supposed to be one of left-sided appendicular disease, the condition, upon operation, proved to be one of diverticulitis. That case was subsequently included in Dr. Mayo's group of six cases in a paper which was published in the *Journal of Surgery and Obstetrics.*

With reference to the presence of blood in the stools, Dr. Erdmann said that in the case he operated on recently the stools contained some blood, which was attributed to hemorrhoids. A proctoscopic examination in this case gave negative results.

Dr. Charles H. Peck said that in one case of diverticulitis of the sigmoid that had come under his observation, the patient was a man, about sixty, who had a generalized peritonitis which was attributed to a ruptured appendix. He died on the fifth day of peritonitis and pneumonia, and the autopsy showed a large number of minute diverticula of about the same size, all grouped within ten or twelve inches of the length of the sigmoid. One of these had perforated; the rest were apparently not diseased, and none of them was large enough to admit a pea.

More recently, Dr. Peck said, in operating on a woman for a volvulus, he found several diverticula of the upper jejunum, all much larger than the one that had perforated in the fatal case that he had referred to above. They were pretty well pedunculated, and showed evidence of having been there for some time.

Dr. Howard D. Collins said he had seen three cases of multiple hemorrhagic infarcts of the small intestine, about the size of a silver ten cent piece, and he suggested that in the repair of such lesions it might possibly lead to the weakening of the muscular structure of the gut and predispose to the formation of diverticula. In one of his cases, where the infarct was at the junction of the duodenum and jejunum, it finally perforated the gut, allowing the discharge of duodenal contents. As in the case shown by Dr. Hitzrot, the discharge was checked by packing.

Dr. Moschcowitz said that since he showed the case of

diverticulitis to which Dr. Hartwell referred in his paper, he had had occasion to operate on another case. This was in a man of seventy-three years who was apparently suffering from peritonitis, and upon opening the abdomen, the peritonitis was traced to an abscess which had perforated, and which originated in the region of the sigmoid flexure. The man was in a wretched condition at the time of the operation, and nothing could be done beyond draining the abscess, which was suspected at the time of being a perforated diverticulitis. Death occurred on the fifth day, and the autopsy showed a number of diverticula of the sigmoid, one of which had perforated.

In addition to these two cases, Dr. Moschcowitz said, he had had occasion to operate on a third case of diverticulitis of the sigmoid, also with fatal issue, and on a fourth, which recovered. He also mentioned the case of an old lady whom he saw with Dr. Langmann some twelve or fourteen years ago. This patient died of a complication of conditions, particularly cirrhosis of the liver, and at the autopsy her colon was found studded with multiple diverticula, looking like rows of beads, and from 500 to 1000 in number.

Dr. Moschcowitz said that while the pathology of intestinal diverticulitis was readily understood, its pathogenesis was more interesting and obscure. From his own reading and study of the subject, particularly in connection with diverticula in other parts of the body, he was decidedly in favor of the view of Krause and Klebs, who claimed that the condition was a diverticulum or herniation of the mucous membrane along the course of the blood-vessels, and it could be readily understood that such lesions were most apt to occur at the points where the vessels perforated the muscularis, thus offering natural points of weakness.

Dr. Eliot reported the case of a man of fifty, who, without symptoms and without apparent cause, developed an abscess in the left abdomen, above the crest of the ilium. It was supposed to be due to a suppurating diverticulitis. Upon opening the abscess and exposing the distended colon, a suspicious hardness of the gut was discovered. A section of this was removed and examined, and proved to be an adenocarcinoma. The case was an illustration of the fact that now and then a carcinoma would undergo suppuration, with the development of an intraperitoneal or intramural abscess, such as occurred in diverticulitis.

Dr. Eliot said the case he had mentioned was the only one he had ever seen of carcinoma of the fixed position of the large intestine that had undergone suppuration.

Dr. Hartwell, in closing the discussion, said that Mayo had reported one case of carcinoma connected with a diverticulum. With reference to a perforating diverticulitis, such a case was reported in the Annals of Surgery, with peritonitis and death, and the autopsy showed an adenocarcinoma. An important point to bear in mind was that all perforating lesions of the large intestine or sigmoid were by no means diverticula. In one case seen at the Presbyterian Hospital the lesion proved not to be a diverticulitis, although no definite etiological factor could be found.

The question of the pathogenesis of diverticulitis was exceedingly interesting. Doubtless the blood-vessels, to a certain extent, determined the course along which these diverticula travelled, particularly in the small intestine, but in the large intestine there was no evidence of any such relation, nor did the diverticula develop anywhere near the mesenteric wall. Again, the mesentery did not show the presence of blood-vessels in close relation to the diverticula, and their etiology, in this section of the gut, at least, was still uncertain. Grasser's view was that they only followed the blood-vessels in cases where the spaces for the latter were in a dilated and weakened condition due to venous stasis. Diverticula differed so markedly in their structure, some having an exceedingly small neck communicating with the sac and others having a very large opening, that it was hard to believe that they all originated from the same condition. It was probable that in their formation different etiological factors were at work.

# TRANSACTIONS

OF THE

# PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting held March 7, 1910.*

The President, Dr. Robert E. LeConte, in the Chair.

## FRACTURE OF THE PATELLA TREATED BY SUBCUTANEOUS PURSE-STRING SUTURE.

Dr. John B. Roberts presented a man to demonstrate the result of the treatment of a fracture of the patella by a subcutaneous purse-string suture (Fig. 1).

He said that two or three times in discussions in regard to the suturing of the patella he had mentioned this method, but never found any one to believe in it but himself, so he had brought this man to prove how satisfactory it is both to the patient and to the operator. It can be done without general anæsthesia, although it is better to give ether, because then the muscles are fully relaxed, and one can press the fragments more closely together with the fingers. By rubbing them together when they are in apposition the edges of the capsule may be displaced from between the fragments. After getting them together, put the wire or string around the bone and then have a skiagraph taken. The apposition is apt to be a little imperfect, but the union becomes so good that for all practical purposes it is as good as the result obtained by the open operation.

This is not Barker's operation, for he passed the ligature around the bone in the sagittal plane, going through the joint and back under the skin over the top of the patella and tied. The method described is a purse-string suture in the coronal plane, going around the bone by passing through the ligamentum patellæ, catching the tendinomuscular tissues on both sides, and traversing the muscle just above the bone. It thus, when tied, draws the fragments together. It is satisfactory for a man who

does not like to give his patient too great a risk, and who is not afraid of aseptic subcutaneous work or of the string breaking.

It is wise to make four punctures through the skin and deep fasciæ at the points of exit of the needle, so that the ligature when tied may sink into the muscular structures and closely grasp the adjusted patellar fragments. The leg should be kept extended for three or four weeks. Then the ligature is removed by cutting the knot with fine pointed scissors and withdrawn. Later careful passive motion is made. Dr. Roberts found the method satisfactory for a number of years past. It is described in Jacobson's operative surgery as used by the speaker.

FIG. 1.

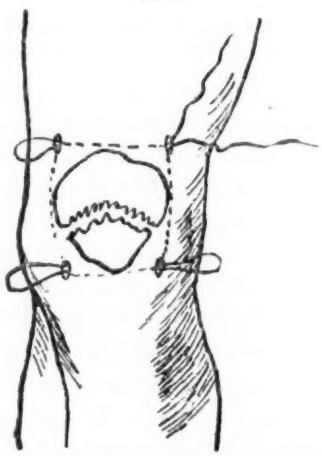


Diagram of purse-string method of treating transverse fracture of the patella.

DR. JOHN B. DEAVER said that he wished particularly to argue against the Barker operation in fractures of the patella. It is no better than a Malgaigne hook or plaster of Paris. If one aims to have bony union, the fragments of the capsule must be gotten rid of, and that is possible only by open operation which allows inspection and exact manipulation.

DR. HENRY R. WHARTON said that the operation done by Dr. Roberts is to his mind practically a modification of Barker's operation, which enjoyed a certain amount of popularity years ago, but which is seldom done at the present time. His reason for feeling that these operations are not satisfactory is that his

experience in opening the knee-joint in operating on fractures of the patella has shown him that in many cases the lower fragment is so drawn out of place that the articular surface is often turned upwards so that it comes in contact with the fractured surface of the upper fragment, and he also does not believe very close approximation can be got in the presence of a large blood-clot, which is another objection to this method of operation. Excepting in such a special case as the one presented, it is better to do the open operation for bringing the fragments into close approximation.

## EXTENSIVE ANGIOMA OF THE UPPER EXTREMITY; VARICOSE VEINS SIMULATING A FEMORAL HERNIA.

Cases of the affections named were presented by DR. DUNCAN L. DESPARD.

DR. WILLIAM J. TAYLOR said that some years ago he reported an instance of a woman who had worn a truss for a number of years for what she had been told was a femoral hernia. She had no varicose veins anywhere. He operated on her and found varicose veins at the femoral ring. He ligated them and she did very well until a gastric ulcer set up mischief, and she finally died of a clot which he thought was the direct result of the gastric ulcer.

DR. JOHN H. GIBBON said he had seen two other cases, in addition to the one shown by Dr. Despard, of dilated veins in the femoral and inguinal regions, one of which was sent to the hospital as a case of hernia. Unless the veins were growing or were giving rise to a great deal of discomfort, he would not feel inclined to operate upon them. With regard to the case of the extensive angioma of the arm which Dr. Despard had shown, this patient was in the Pennsylvania Hospital nine years ago when the condition was not nearly so extensive, and at that time Dr. Harte tried the hot-water injections recommended by Wyeth. One of the interesting features in this case is the marked atrophy of the bones of the arm.

DR. HENRY R. WHARTON recalled a case at the Children's Hospital some years ago. The patient, an infant about one year of age, had an extensive angioma involving the shoulder and extending out into the pectoral muscles, which he attacked with the galvanocautery. A very fine Paquelin point was made and

applied, heated, at a number of points; the case was under treatment for several months and finally got well. Of course, if this had been allowed to go without treatment, it would probably have developed into a condition much like that of Dr. Despard's patient.

Dr. A. P. C. Ashhurst, referring to the case of angioma, said that nearly four years ago he showed before the Academy a 12-year-old girl with an angioma quite as extensive in area but not nearly so large as this boy's, and the Fellows thought then that the prognosis was rather gloomy; but he had hunted her up recently and found that she is much better. The swelling is not so great when the arm hangs down, and she has developed very well, although the upper extremity is two inches shorter than the other one. Therefore, in the light of the improvement in his own case, he should give a more favorable prognosis in Dr. Despard's case and should be inclined to leave it absolutely alone. The boy says he can use this hand as well as the normal one, and experiences no handicap at his work.

## VOLVULUS OF THE SIGMOID.

Dr. Edward B. Hodge said that aside from the comparative rarity of sigmoid volvulus, this case is of interest from its history and from the size of the sigmoid.

J. K., aged 60 years, male, was admitted to the Presbyterian Hospital in November, 1909, on the fifth day of the attack. He had always been constipated, except for a few months six years ago, and again four years ago, when he had three to four very loose stools a day without pain. Two years ago he began to have attacks of partial obstruction three to four times a year. For two days there would be increasing tympanitis, no passage of flatus, slight colicky pain in left iliac fossa, radiating toward the umbilicus, and discharge of watery fluid from the rectum several times in the twenty-four hours. Then he would take a purge, and obtain relief after passage of very large, soft stool and much flatus; appetite good always.

Present attack was identical for two days, except that anorexia was present. There was no result from the usual purge on the third day. The distention became worse, with pain present but not increasing. On the fourth day he consulted his physician, who could find nothing pathological in the abdomen, and ordered a dose of castor oil. This was without effect, and the distention

steadily increased. On the fifth day his doctor gave him a two-quart enema, which was retained. Two hours later this was repeated, with the same result. Later another injection was returned as fast as given. Vomiting, which had been absent, now began, and he was brought to the hospital at 8 P.M.

His general condition was fair. Temperature 99.8°, pulse 120, respiration 24. There were extreme symmetrical distention, tense abdominal walls, through which nothing could be felt; no rigidity; slight general tenderness and dulness in the flanks, particularly the left. Peristalsis was absent. Rectal examination showed nothing but a much dilated rectum.

Left inguinal colostomy incision was made under ether. Slightly distended small intestine and descending colon presented. The obstruction was felt at the pelvic brim, and an enormously dilated sigmoid was lifted out. This was so large and the mesentery so long that the one loop of bowel had caused most of the distention. It extended to the liver and ensiform cartilage. The bowel was twisted from right to left through 360°. The twist was released, and bowel wall and mesentery found in good condition. There were no signs of adhesions or inflammation. With the loop hanging well over the edge of the table, a large quantity of gas and fluid was evacuated by incision. This was closed in the usual manner and the sigmoid returned to its proper place. The abdominal wall was closed by layer sutures without drainage. The patient's general condition was not thought good enough to warrant any procedures to prevent recurrence of the attack.

The patient made a smooth recovery and has been in excellent condition ever since.

Volvulus is generally credited with 3 to 4 per cent. of intestinal obstructions. Recent observations tend to give a higher percentage. While the present is the only instance of volvulus recorded at the Presbyterian Hospital in the last ten years among 61 intestinal obstructions, 57 operations at the Pennsylvania Hospital in the last five years give 7 of volvulus, 3 being of the sigmoid. This case is a fairly typical example of the recurring or subacute type. Careful attention to the history will often show symptoms extending over a term of years. This patient had six or eight attacks of partial twisting in two years. One of Blood-good's [1] cases had thirty-two attacks in sixteen years.

[1] ANNALS OF SURGERY, 1909, xlix, 161.

The important factors in etiology seem to be: (1) constipation; (2) long mesentery; (3) approximation of the foot-points of the loop; (4) adhesions; (5) age, 40 to 60; (6) male sex, 80 per cent. It is generally held that the drag of a sigmoid overloaded with gas and fæces elongates the mesentery of its pelvic portion, and so favors twisting. If, in addition, the foot-points of the loop are close together, volvulus is still more liable. The size and weight of these distended loops are hard to believe until seen. In his case he believed that most of the first two enemata passed into the sigmoid and were retained there, the weight then serving to increase the twist and make tighter the obstruction.

Why the proportion of male to female should be 4 to 1 is hard to understand, if constipation plays much of a rôle. Perhaps an elongated mesentery on the pelvic sigmoid is more frequent in the male, though the speaker could find no studies throwing any light on this or any other anatomic difference in the sexes.

High enemata in the knee-chest position will often relieve partial sigmoid volvulus. This failing, laparotomy, with untwisting of the volvulus and evacuation of the bowel by a rectal tube or incision, is demanded. To prevent recurrence, said to be usual, the sigmoid may be sutured to the lateral pelvis wall, or the mesentery folded on itself parallel to the bowel. Resection of the loop will be required for gangrene.

## ULTIMATE RESULT OF EXCISION OF THE ELBOW-JOINT.

Dr. H. R. Wharton presented a woman, aged 50 years, whose left elbow-joint he excised fifteen years ago, for disability resulting from a fracture of the condyles and posterior dislocation of the bones of the forearm at the elbow of some months' standing. The patient did well after the operation and in a few months had good functional result. The functional result after fifteen years is good.

Dr. Wharton added that the principal point in obtaining a good result in excision of the elbow-joint is to remove the ends of the bones freely, and to begin passive motion not later than the third week. In excising the elbow-joint he also endeavored to retain the attachment of the triceps muscle to the ulna so that the patient will have more than gravity extension of the forearm. He divides the tendon of the triceps and divides the attachment

of the triceps to the olecranon and periosteum from the bone to a point below the bone section, and finally after the excision of the bones is completed unites the severed tendon by sutures. This procedure seems to give the patient better power of extension of the forearm.

Dr. G. G. Davis, in commenting on excisions at the elbow, called attention to one point in the structure of the part. In fracture of the patella, the amount of separation is practically dependent upon the extent of the tear in the tissues on each side of the patella. The olecranon in the upper extremity is the homologue of the patella, and the olecranon, like the patella, has a fascia extending to the sides, which in a fracture of the olecranon will tend to hold it in place provided it is not too widely torn. The internal condyle lies close to the olecranon and between them runs the ulnar nerve and the fascia. There is a distinct fascia going from the side of the olecranon continuous with the tendon of the triceps and the internal condyle, but the distance is so short and this fascia so loose that it does not bear an important part in resections. When it comes to the outer surface of the joint from the external condyle to the side of the olecranon is a considerable distance, and if one traces down the tendon of the triceps he finds it inserts not only into the olecranon but passes as a broad sheet between the external condyle and the olecranon to be inserted into the upper one-fourth or one-third of the posterior surface of the radius, hence it is that when this is not divided in resections of the elbow-joint one frequently gets good results. It is obvious that one must expect a certain amount of weakening in the power, because an inch to an inch and a half of bone has been removed.

Dr. John H. Jopson said that he had recently practised a method of preserving the attachment of the triceps in excision of the elbow, which he saw described some time since. It consists in sawing through the olecranon transversely, about one and a half inches below its tip, and turning the detached portion upward, with the tendon still attached. An excellent exposure of the joint is thus obtained. In traumatic cases where the olecranon is uninjured there is no necessity for removing any portion of it. In tuberculous cases the under surface if diseased can be removed by sawing off a slice. After concluding the operation of excision, the olecranon is dropped back and wired to the ulna.

## PNEUMOCOCCIC PERITONITIS.

Dr. Henry R. Wharton presented a girl, aged 8 years, who was admitted to the Presbyterian Hospital May 22, 1907, with the history that one week before her admission she suffered from abdominal pain, fever, and cough. She was seen by her physician, Dr. Ellinger, the day before her admission, who found her with a high temperature, pneumonia of the right lung, and a tender and distended abdomen.

When examined after admission her temperature was 103°, pulse 140, respiration 40. There was pneumonia of the right lung. The abdomen was moderately distended, rigid, and tender on pressure.

Under ether anæsthesia an incision was made over the region of the appendix, and when the peritoneum was opened a quantity of thick, yellow, odorless pus escaped. This purulent fluid seemed freely distributed through the abdomen and the pelvis. The appendix was normal in appearance; it was removed. Gauze and rubber drainage was introduced into the abdomen and into the pelvis, and the wound was partially closed by sutures.

An examination of the pus found at the time of opening the abdomen showed a pure culture of pneumococcus.

The day following the operation pneumonia of the left lung developed. The patient was critically ill for some weeks, and there was free discharge from the abdominal incision. The patient finally recovered and was discharged from the hospital in August. At the present time she is in good health.

Dr. Wharton remarked that pneumococcic peritonitis may exist as a primary or secondary affection. In the former case it is due to the primary idiopathic infection of the peritoneum by the pneumococcus; and in the latter arises from the infection of the peritoneum by the same organism in the course of pneumonia, pleurisy, or meningitis. A study of 74 cases of this affection by Savestre and Aubertin showed that the disease was primary, that is, the chief or only focus of pneumococcic infection, in 47 cases. In 140 cases of peritonitis examined bacteriologically, Netter found this form of infection only in two cases. Rollerston considers it a comparatively rare disease, although a number of cases have been reported by individual observers. Jansen has collected 106 cases of pneumococcic peritonitis.

Primary pneumococcic peritonitis is considered by Comly to be more frequent in children than in adults. Rollerston considers the disease primary in about one-half of the cases observed. All observers agree as to the greater frequency of the disease in childhood. Under 15 years of age the disease is much more commonly observed in girls than boys; according to Armand and Bowen, who collected 91 cases, the proportion was 3 to 1; while after this age its occurrence was equal in the two sexes.

When secondary, the disease may follow pneumonia, pleurisy, pneumococci gastro-enteritis, or appendicitis. The comparative rarity of the development of pneumococcic peritonitis in pneumonia is well shown by Rollerston's statistics: in 4454 cases of pneumonia, peritonitis was found only in 11 of the fatal cases, 0.025 per cent. The same authority points out the following channels through which the bacteria reach the peritoneum: (1) the blood stream; (2) stomach, intestines, and appendix; (3) pleura, through the diaphragm; (4) the Fallopian tubes.

While the disease may be primary or secondary, it is probable that hæmatogenic infection plays a most important part in its development.

Pneumococcic infection of other serous membranes may occur in addition to that of the peritoneum, especially in young children. The onset of the disease is sudden. The symptoms are abdominal pain, fever, and vomiting; these symptoms are so similar to those of acute appendicitis that the conditions are likely to be confounded. The acute symptoms may subside or become chronic, and the condition may resemble typhoid fever or tubercular peritonitis. Nutall describes two types of the affection: the acute, fulminating, diffused form, which is often fatal; and a form in which the onset is acute, but the progress is slow, which leads to the formation of a localized abscess. The lower abdomen is usually involved, and in a large majority of the cases this purulent collection becomes encysted, and the abscess occurs in the region of the umbilicus and tends to point. According to Armand and Bowen recovery followed in 86 per cent. of encysted cases and only in 14 per cent. of cases presenting the diffused form of the disease.

In view of the good results obtained in peritonitis by incision and drainage, it would seem wise to subject cases of pneumococcic peritonitis as early as possible to the same treatment. In

the diffused cases, in addition to incision and drainage, the Murphy method should be employed. In the encysted cases, incision and drainage only would be required. Nutall recommends in the diffused form of this disease, if the diagnosis is made sufficiently early, the use of antipneumococcic serum and a trial of the vaccine method of treatment.

## VALUE OF TENOTOMY IN SOME CASES OF FRACTURE OF TIBIA AND FIBULA.

Dr. Henry R. Wharton said that in February, 1910, he was asked to see a lady in a town about 40 miles from Philadelphia, who had sustained a fracture of the tibia and fibula near the ankle-joint, in which it was found difficult to correct the deformity. The injury had occurred ten days before he saw her.

When he examined the patient, he found the limb much swollen, the foot flexed and drawn backward, simulating the deformity of a posterior dislocation of the ankle, and a marked projection of the lower end of the tibia above the ankle-joint.

The limb had been treated in a fracture-box, and there was a gangrenous spot the size of a dollar over the point of the heel. The deformity had been reduced on several occasions, but each time it had recurred.

She was sent to the Presbyterian Hospital the following day, and a skiagraph taken, which showed a fracture of the internal malleolus, a fracture of the lower end of the fibula, and a posterior displacement of the astragulus, which carried backward with it the foot and the fragments of the tibia and fibula.

After being etherized, it was found that by extension and manipulation only a partial correction of the deformity could be obtained. He therefore divided the tendo-Achillis subcutaneously, and was then able to reduce the fragments and correct the deformity completely. The limb was held in the corrected position and a plaster-of-Paris bandage applied, with provision for trapping over the gangrenous spot in the heel.

The patient did well after this, and was discharged from the hospital in eight weeks, with firm union and the bones in good position; she walked well and had normal motion at the ankle-joint.

Dr. Wharton said many cases of fracture of the tibia and fibula occur in the location of the one just reported, in which the

deformity is not very marked; but occasionally the deformity described above is met with. It is possible that in such cases there has been extensive laceration of the anterior tibial-tarsal ligament and lateral ligaments, in addition to the injury of the bones.

He had had in his own practice four or five cases of fracture of the tibia and fibula near the ankle-joint, where it was impossible to correct the deformity by ordinary methods, in which he had resorted to tenotomy of the tendo-Achillis to assist in the correction of the deformity. In all of these cases the result was eminently satisfactory, both as to the correction of the deformity and the subsequent use of the limb.

DR. G. G. DAVIS remarked that when the leg bones are broken, usually the upper fragment projects forward and the lower fragment is carried backward. The preponderance of muscles is posteriorly and renders this displacement marked and persistent. If one eliminates the muscles of the calf we have the muscles practically balanced. The muscles of the leg are practically of four sets, an anterior extensor set, comprising the anterior tibial, the extensor hallucis, and the extensor communis, and a posterior set, the posterior tibial and flexors of the toes and of the big toe; three abductors; the peronei muscles are on the outside and anteriorly and hardly take much part in flexion and extension, but the muscles of the calf, the gastrocnemius, soleus, and plantaris, have nothing to oppose them, therefore after dividing the tendo-Achillis there remain three muscles on the front and three on the back. The first thing to do in treating these displacements is to get rid of the action of these calf muscles, and by placing the leg in the Potts position (flexed on its outside) it is often easy to bring the foot into place. The use of adhesive plaster extension is likewise successful in some cases, but in a certain proportion of cases both these methods will fail, and then one is confronted with two propositions, one being to open up the fracture and bring the bones in apposition, wiring or fastening the fragments in place, and the other is the division of the tendo-Achillis. Of course, the division of the tendo-Achillis is the less dangerous of the two and it is very efficient. He had employed it for many years, but the question has always remained in his mind as to whether or not the division is accompanied by a permanent weakening of the functions of that limb. If one

operates by open section and deliberately replaces the bones, fastening them with wire, the leg is practically normal again. If one divides the tendo-Achillis, when the patient gets well his bones unite and he has a good looking limb, but to what extent do these calf muscles regain their original strength?

Dr. Robert G. LeConte agreed with Dr. Wharton that in the type of fracture which he showed, division of the tendo-Achillis is the expedient form of treatment. He had done it three or four times with good after results. There is always some atrophy of the calf muscles following, as there is after a traumatic rupture. In two cases he had seen of rupture of the tendo-Achillis from muscular violence, the limb in each instance has recovered perfectly from a stand-point of usefulness, although never coming back quite to the original measurements; so much so, that the patients are unaware now on which side the rupture occurred.

## CALCULOUS CHOLECYSTITIS.

Dr. John H. Girvin reported the following cases:

Case I.—A woman, age 40 years. Healthy until age of 17, when her child was born. Was never well after that. Seven years ago was operated for pyosalpingitis.

*Present Illness.*—Seven months ago had a severe attack of pain in epigastrium. Recovered in two weeks but soreness in right side continued for several weeks. No jaundice. Three weeks before admission a similar attack associated with severe vomiting, which improved under diet and treatment but did not clear up. This became much worse two days before admission to Presbyterian Hospital on January 12, 1910, at which time she was suffering severe pain. Had inspiratory catch. Upper abdomen very rigid and exquisitely tender. Three days later the pain had disappeared but some tenderness and rigidity remained, which gradually diminished until it was possible to outline a distended and tender gall-bladder.

*Operation* (January 22, 1910).—Vertical incision through edge of muscle. Gall-bladder exposed only after breaking up many adhesions. Incised and evacuated a clear thin fluid like bile, followed by thick creamy pus. At the beginning of the cystic duct was found a single stone the size of an ordinary marble which was removed with a curette. Uneventful recovery.

Case II.—Woman, aged 37. Two years ago after typhoid

had a dull heavy pain in back which became severe and cramp-like and moved along the right costal margin to the region of the gall-bladder, where it became very severe, causing vomiting. Next day all pain gone but very sore and weak. Six or eight months later had a similar attack but more severe and longer. Up to admission patient has had five such attacks—each more severe and at shorter intervals. Last attack three weeks before admission. Never jaundiced; bowels moving by medicine since last attack and apparently normal.

When admitted there was no marked tenderness over gall-bladder region, and the gall-bladder could not be palpated.

*Operation* (February 5, 1910).—Vertical incision at edge of rectus. Liver seems freely movable downward, and under the edge of liver, bound up in a dense mass of old adhesions, was found a small thick-walled gall-bladder, to the lower edge of which was a dense adhesion to the bowel which resembled a fistulous tract but contained no opening. This was separated and only the necessary adhesions broken up. The gall-bladder was opened and a culture made of the clear non-purulent fluid. This showed a pure culture of the typhoid bacillus. A stone exactly like that in the previous case was removed from the same locality. Drainage tube inserted and an attempt made to invert edges, but this was very difficult on account of the thick walls of the gall-bladder and its very friable condition. Packing removed and a small gauze drain inserted to the region of the intestinal adhesion. Recovery uneventful but for bronchial irritation for first three or four days—temperature 101°.

Case III.—Woman, aged 59 years. About two years ago struck her side on edge of table and was very sore for some time. After this, began to notice a swelling in region of the gall-bladder which was almost constantly sore. Had symptoms of indigestion but no vomiting and no distinct jaundice, although there is some cachexia. Her general health seemed to fail and she became so weak that she has been in bed for past three months. Came to city about two weeks ago and has since been under the care of Dr. Somerkamp, who made the diagnosis of gall-bladder disease.

*Operation* (January 5, 1910).—Incision was made along right rectus. Gall-bladder found enlarged and walls thickened; full of all size stones. One apparently in the common duct. It

required a large incision in the thick and friable walls to get out the large stone, which measured 1½ inches long. Drained as in other cases. Operation prolonged and patient in poor condition and rather shocked. Color very poor. At end of twenty-four hours, temperature 102°, pulse poor, and not much drainage. January 7, slightly better but some evidence of congestion over base of right lung—later in day had an attack of heart failure but rallied. Lung condition progressed. Wound doing very well. Bowels moved freely and no distention. Lung and heart condition grew worse and she died at the end of two weeks from the heart and lung condition. She had been septic and with a myocarditis for several months and was in very bad condition at time of operation.

Dr. Girvin remarked as to diagnosis in these cases: In the first case the condition was plain. The local tenderness was unusually marked. From the literature it seems that the order of frequence of the bacterial cause of cholecystitis is as follows: (1) colon bacillus; (2) staphylococcus; (3) streptococcus; (4) typhoid; (5) pneumococcus, and after that a number of other varieties, but he was inclined to think that typhoid should be higher in the list. Cushing found that 10 in 31 cases had had typhoid. Flexner and Chiari found the typhoid bacillus in the bile in almost all cases dead from typhoid. It is interesting to note that the bacillus has been found in the gall-bladder operated upon seventeen or eighteen years after an attack of typhoid fever (Droba and Hunner). The infection of the gall-bladder may come either through the blood or from the intestines by the ducts (although this method has been questioned), but the source, while it may be anywhere in the body, is usually from the intestines.

In the second case the cause was plainly typhoid, and the picture was typical of a chronic cholecystitis. He was at a loss to suggest the cause in the third case and was not sure that there was not a malignant process associated with the chronic gall-stone disease. None of these cases has had jaundice.

As to the technic of operation, he had followed the incision used by Bevan parallel to the muscle. Pack off very carefully and do not break up old adhesions more than possible. He had drained with a fairly large rubber tube wrapped with gauze and rubber tissue and stitched to the inverted edges of the gall-

bladder with plain catgut. Drain into a sterile bottle (bile excoriates skin). He had usually tried to attach the peritoneum to the gall-bladder and closed with silkworm gut interrupted sutures, using small gauze drains at either side of the tube. The tube usually comes out very easily by the ninth or tenth day and the wound will close soon if the gall-bladder edges are inverted. This method of operation seems best adapted to this class of cases.

Each of these cases had impressed him with how easy it is to overlook a stone and how thorough and careful the search in the ducts should be. The complication of a recurrence of the symptoms from an overlooked stone is not uncommon.

Dr. John B. Deaver said that gall-stones play an important rôle in connection with disease of the upper abdomen. But in more than 700 cases of acute intestinal obstruction he had met with but 2 cases of intestinal obstruction due to stone in the small bowel. It is his experience that more cases of obstruction of the cystic duct are caused by single than by multiple stones.

The typhoid bacillus plays an important part in the causation of cholecystitis. In his cases he had found that the colon bacillus had been more common than the typhoid bacillus; then the pyogenic organisms, and then the pneumococcus is the order of infection. The avenue of infection is most commonly through the portal circulation. He had had two interesting cases in this connection, bowel resection following femoral hernia; one in which the gall-bladder perforated, and both operated on for that condition. In these cases it was evident that the infection reached the gall-bladder through the portal circulation.

With regard to the question of recurrence, he had operated in many instances where it was problematical whether there was stone or not, and in practically all he found the recurrence of pain due to adhesions. He recalled one case in which a recurrence occurred in six weeks, jaundice, violent pain; he opened this patient's belly and all she had was adhesions; she is well at the present time. He had seen a number of instances of that character. He was glad that Dr. Girvin did not excise any of his gall-bladders. He excises a portion but rarely the whole organ. He was convinced, however, that men who take out the greatest number of gall-bladders are the men who see the smallest number of cases.

The question of technic as presented by Dr. Girvin is very good, but he could not endorse stitching the gall-bladder to the parietal peritoneum. He drops all his gall-bladders, putting in a purse-string suture, and inverting the edges. In some he placed a cigarette drain down to the gall-bladder.

Regarding drainage, he uses a cigarette drain in connection with the tube that is in the gall-bladder secured by purse-string suture. He elevates the foot of the patient's bed so as to confine the fluid to the field of operation. If there is oozing he passes a glass drainage tube down to the subhepatic fossa.

Dr. John H. Jopson said that he saw all of the cases reported by Dr. Girvin. The most interesting was the case in which there was a history of typhoid fever two years previously. She had a very movable right kidney, and her attacks of pain had been attributed by one medical consultant to twisting of the pedicle. On operation the picture of chronic cholecystitis was typical, there being very firm adhesions to the bowel, one so dense and large that a fistulous communication with the intestine through it was looked for but none was present. In connection with the subject of cholecystitis, he could report a case of acute cholecystitis developing during convalescence from operation for appendiceal abscess, a rare complication, examples of which have been reported by H. R. Wharton and others. The patient was a woman, 55 years of age, with an abscess of appendiceal origin which had been drained and the appendix removed three weeks before. The onset of inflammation in the gall-bladder was acute, with pain, fever, and gastric disturbances, followed by development of a palpable swelling. The gall-bladder was drained a week later, four weeks after the operation for appendicitis, and contained much pus but no stones, and a pure culture of *Bacillus coli* was obtained. The patient recovered.

Dr. John B. Shober agreed with Dr. Girvin that the typhoid bacillus is responsible for a larger percentage of cases of calculous cholecystitis than is generally admitted.

If the nuclei of all the stones removed from any one case are carefully examined, pure cultures will be found in one or more stones and may be absent in all the others. Hence the importance of examining all the stones before a negative report can be made. He was convinced that many cases are overlooked when this rule is not observed. Such cultures are found many years after the occurrence of typhoid fever.

In operating upon these cases, the most important consideration is to secure free drainage not only of the gall-bladder but of the ducts. When this is properly accomplished by means of large calibre tubes, as a rule stones which were not removed or which were overlooked at the time of operation will pass later.

Experience had taught him to avoid cholecystectomy except in rare cases.

## CYSTIC DISEASE OF THE BREAST.

Dr. William J. Taylor read a paper on "The Clinical Aspect of Cystic Disease of the Breast," for which see page 253.

Dr. John H. Gibbon said that he would practice complete removal of the breast only under the following circumstances: first, where cystic disease has existed for a long time; second, where there are multiple cysts; and third, where there is recurrence after operation. A single large cyst of short duration demands the Warren operation. It is only after these cysts have existed for a long time that the malignant change takes place. Thirteen out of twenty-six is an enormous percentage, and he would like to know, if possible, how long the cases which were not malignant had existed before operation, and how long the condition had existed in those which were found to be malignant, as this might help to prove the assertion regarding the duration. He had had only one case of malignant cyst, although many of cystic disease in the last few years. This one in which a malignant change took place was a case of multiple cysts of both breasts with complete removal of both breasts and no recurrence after three or four years. McGraw and Abbe recommended the evacuation of these cysts with an aspirating needle and he has done this in three cases without any recurrence. He would not, however, recommend this method of treatment.

Dr. John B. Deaver thought every woman who had a tumor in the breast was a case for immediate operation. At the German Hospital, where from 75 to 100 cases a year are operated upon, he had often been surprised in cases which he considered simple cysts to have the pathologist's report come back stating that malignant change had taken place. Consequently in more recent years they had made it a rule to have every case examined immediately at the time of operation. In a certain percentage of cases the report comes back in five or six minutes of a malignant change, and then he removes the breast.

Dr. John Speese said that the very high per cent. of malignancy occurring in Dr. Taylor's cases was rather surprising in view of the fact that other writers have found that only 15 to 20 per cent. of the cases of chronic cystic mastitis become carcinomatous. He should be inclined, therefore, to think that Dr. Taylor's cases were seen at a more advanced stage of the disease or that he has included other varieties of disease in his collection. In reviewing the series of cases recently reported by Dr. Speese before the Academy, particular attention was paid to the possibility of a recurrence or malignant transformation in the cases in which plastic resection of the breast had been performed. In no instance had this complication arisen, so that he felt that the operation was safe in properly selected cases, and was especially desirable from the cosmetic stand-point, as the nipple and skin are preserved.

Dr. G. G. Ross said that he had on four occasions started out to remove a cyst by the so-called Warren operation and ended by taking out subcutaneously the whole gland, leaving just the fat, skin, and nipple. He found this very easy and perfectly practicable, and it left a good cosmetic result.

Dr. William L. Rodman said that he had always held to the opinion that cystic disease of the breast, if not malignant in a large percentage of cases, was at least potentially malignant, and no one could say what is to be the end result in any case of cystic disease of the breast. No one even at the time of operation can tell macroscopically whether the cyst has undergone carcinomatous change. The former teaching, that if the contents are clear the chances are altogether in favor of benignancy, is far from accurate and should not be followed. Halsted has made this very clear; the thin-walled cysts with perfectly clear fluid are oftentimes the most malignant forms of cystic disease. The only safe way to treat such cases is to have an examination made at the time of operation. He had used the frozen section method for seventeen years and in all that time had known but two mistakes to be made, and one of them by a person of little experience with frozen sections, and he always employed and depended upon frozen sections in every doubtful case. He was in accord with Dr. Gibbon's attitude as to the probable malignancy in cases where there are multiple cysts. On this account the operation of Warren is not always to be advised; this is a

far more satisfactory operation where the cysts are single, but even where they are multiple and seem to be limited to a circumscribed portion of breast, one can afford to take the chance of the mistake being made by the frozen section and wait until a secondary report can be made. Halsted has, however, made this fact clear, that if one overlooks a malignant cyst at the time of the first operation and waits for a report in two or three weeks, the probabilities are that the whole wound has become inoculated; therefore such cysts oftentimes are the most malignant tumors to be found in the breast. He was very partial to Warren's operation; like all good things, however, it has limitations, and one should practise it only where there is a competent pathologist at hand to make a report.

As to the value of the X-rays following operations, he had changed his view entirely in recent years. Formerly he thought it perhaps best to supplement all operations by their use, but he never did so at the present time unless he thought the case a borderline one and that diseased tissue may have been left. He could see no reason why the X-rays should be used unless diseased tissue has been left, and in a complete operation this should not happen. Personally, he had not seen any abiding result from the use of X-rays in the case of carcinoma excepting in the superficial squamous epitheliomata which occur about the face and other parts of the skin. He had seen most excellent results follow the X-rays in sarcoma, not only of the soft tissue but in bones. In carcinomata the improvement has invariably been only temporary.

While he had recognized for years that the percentage of cases of cystic disease of the breast either primarily malignant or undergoing malignant change was a large one, he had not found it as high as reported by Dr. Taylor. This should make us most cautious in dealing with cysts in the breast.

Dr. George P. Muller emphasized the fact that the diffuse hyperplasia of the breast, commonly called chronic cystic mastitis, is a different disease from the malignant or cancer cysts. The previous speakers seemed to make no distinction between them, and if such distinction is not made he agreed with them that radical operation should be done in all cases of cystic disease of the breast. If one was familiar with the surgical pathology of the breast, and especially had had some years of experience in

the handling of specimens of this disease, checking up gross observations with microscopic examinations made from numerous places, one is able at the time of operation, in an occasional case, to determine whether or not the growth may be confidently considered to be benign. He, therefore, believed that radical operation should be the rule, but that occasionally it was possible to safely perform some such conservative operation as the plastic procedure described by Warren.

# CORRESPONDENCE.

## SUTURE OF THE RECURRENT LARYNGEAL NERVE.

EDITOR ANNALS OF SURGERY,

DEAR SIR: In the ANNALS OF SURGERY for April, 1910, I reported a case of suture of the recurrent laryngeal nerve. In this article occurs the following: "A thorough search of the literature in the library of the Surgeon-General's office, at Washington, has not revealed a single case of suture of this nerve in man. Consequently, the case reported below is apparently unique."

Dr. W. W. Keen, of Philadelphia, has kindly called my attention to the report of a case of suture of the left recurrent laryngeal. The report was made by Föderl (*Wien. klin. Woch.*, 1896, 1258) and is entitled "On Resection and Suture of the Trachea." Suture of the recurrent laryngeal nerve under such a title can easily be overlooked and if it had not been for the accuracy of Dr. Keen in keeping an index of such cases I doubt if I could have found this reference. Certainly it could not be reached by any of the ordinary methods of hunting up the literature. Föderl makes no point of the suture of the recurrent laryngeal, but speaks of it rather incidentally. The case was that of a boy with a cut throat. The trachea was completely severed. The patient came under the care of a Dr. Lähne who sutured the trachea, the recurrent laryngeal nerve, and the muscles. The technic of suturing the nerve is not mentioned except that the structures were sutured with silk. The anterior portion of the tracheal wound was not closed, and a canula was inserted. The wound healed well, but stenosis occurred and a low tracheotomy had to be done. After this, the results appeared satisfactory and recovery was complete in four weeks. The innervation of the recurrent laryngeal nerve was reported to have been complete four weeks after the injury.

It is certainly unusual to find complete regeneration of any motor nerve in such a short time as four weeks. However, without any criticism of the case reported by Föderl, suture of the

recurrent laryngeal as reported in my article might still be said to be unique, as in Föderl's case it was merely an incident in the repair of a cut throat, whereas in my case the operation was planned and undertaken for the sole purpose of restoring the function of the recurrent laryngeal. The conditions are similar to the ligation of the femoral artery in amputation of the thigh, and the ligation of the femoral in continuity. In the first instance, the ligation is an incident in the operation, in the second it is a distinct operation in itself with an entirely different technic.

Respectfully yours,

J. SHELTON HORSLEY.

RICHMOND, VA., April 27, 1910.

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